

IMMATURE STAGES OF THE SKIPPER BUTTERFLIES
(LEPIDOPTERA: HESPERIIDAE) OF THE UNITED STATES:
BIOLOGY, MORPHOLOGY, AND DESCRIPTIONS

BY

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Abstract of Dissertation to the Graduate School
of the University of Florida in Partial Fulfillment of the
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IMMATURE STAGES OF THE SKIPPER BUTTERFLIES
(LEPIDOPTERA: HESPERIIDAE) OF THE UNITED STATES:
BIOLOGY, MORPHOLOGY, AND DESCRIPTIONS

By

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The purpose of this study was to investigate the biology of as many U. S. skippers as possible, compare morphological features of their immature stages, and produce standardized descriptions. This revision summarizes of our current knowledge of immature stages of North American Hesperiidae, and provides a framework for future taxonomic and systematic studies.

About 300 species of skipper butterflies (Hesperiidae) have been reported from the United States. Most of the fauna is composed of the subfamilies Pyrginae and Hesperiinae, but Pyrrhopyginae, Heteropterinae, and Megathyminae are also represented.

Species of Hesperiidae found in the U. S. feed on 31 families of plants as larvae. These include 8 families of monocots and 23 families of dicots. Most (92%) of these butterflies are limited to only 1 of the 31 families of plants, but a few skipper species feed on plants in 2, or

very rarely, as many as 6 different families. Species having relatively broad host ranges include *Lerema accius* (35 spp.), *Epargyreus clarus* (31 spp.), *Thorybes pylades* (27 spp.), and *Megathymus yuccae* (27 spp.). One hundred and thirty-eight new host records are reported for 55 species of hesperiids. Some skippers are important pests of beans, rice, sugarcane, and pasture grasses. Host plants remain to be discovered for 22% of the U. S. Hesperiidae.

The eggs of 49 species, the larvae of 156 species, and the pupae of 120 species of Hesperiidae of the U. S. are described in this thesis. These include the eggs of 16 species, the larvae of 41 species, and the pupae of 35 species that were previously unknown. Twenty-six percent of the U. S. skippers are totally unknown with respect to their egg, larval, and pupal stages. About half of these species with undescribed immatures are breeding residents. The other half are neotropical species that rarely enter the U. S. and probably do not reproduce within its limits.

Larval characters that may prove useful to systematists conducting phylogenetic analyses include the type of mandible articulation, setal types, sculpturing of the head, lenticle distribution on the larvae, wax gland patterns, and pigments. Differences in the sculpturing patterns of hesperiid eggs have been known for some time, but have not been extensively surveyed. Promising characteristics of the pupae include the shape of the pupal cap, lenticle

distribution, relative length of the antennae and proboscis, cremaster shape, type of thoracic spiracle guard, and presence of crenulations on the posterior margin of the prothorax.

CHAPTER 1
INTRODUCTION

Adult skippers (Hesperiidae) are thick-bodied butterflies with large compound eyes, wide heads, and conspicuous labial palps. The antennal club is usually bent and has a tapering extension called the apiculus. The radial veins of the forewings all arise from the discal cell, and the second medial vein of the hindwings is absent or weakly developed. All six legs are well-developed and used for perching. Many skippers are drably colored, but some tropical species are bright yellow, red or iridescent blue or green. The wings are frequently dotted with semihyaline whitish spots. The Hesperiidae is a group that is easily recognized as distinct from all other butterfly families.

Skippers occur in all faunal regions of the world except at the poles (Heppner 1991). Estimates of the number of described species range from 3000 to 3658 (Robbins 1982, Bridges 1983, and Heppner 1991). The Neotropics are especially rich in skippers, with 2,016 described species (Heppner 1991), followed by the Old World tropics, with 570 species in the Oriental region and 440 species in the Ethiopian region. Among temperate regions, the Nearctic has

more species (290) than Australia (191) or the Palearctic (155). Overall, about 63% of all described species of skippers occur in the New World.

Within the Hesperiidae, eight subfamilies have been recognized (Heppner 1991). The Heteropterinae is the smallest subfamily, with only about 30 species distributed in the Palearctic, Nearctic, and Neotropical regions. The Megathyminae is another small subfamily of about 50 species. Megathymines are found in xeric areas of the United States, Mexico, and Central America. The Coeliadinae is a group of about 80 species restricted to the Old World tropics. Another Old World group, the Trapezitinae, includes about 85 species endemic to the Australian faunal region. Euschemoninae consists of a single Australian species, *Euschemon rafflesia*. Some 180 skippers of the subfamily Pyrrhopyginae occur in the Neotropics. The two largest groups, the Pyrginae (1,195 species) and the Hesperiinae (2,044 species), are widely distributed throughout the world.

Some hesperiids are economically important to people. The larvae of one species, *Aegiale hesperiariis*, known as *gusanos de maguey* in Spanish, are eaten as a delicacy in Mexico (Blasquez 1870). The Indians of Mexico have long harvested *gusanos de maguey* for food (Draudt 1924). Today, these hesperiid larvae are collected and sold fresh or canned in Mexican markets (Borror et al. 1954), and are

fried before eating (Ancona 1934, Sokolov 1989). Small larvae are sometimes added to bottles of tequila as a garnishment (Sbordoni and Forestiero 1985, Toliver 1987).

Skippers are also pests of crops, forests, and plants used as garden ornamentals. *Urbanus proteus* is destructive to beans (Comstock 1881, Riley and Howard 1893, Chittenden 1902, Cotton 1918, Watson 1919, Wolcott 1933, Greene 1971, and Heppner 1975), *Ancyloxypha numitor*, *Panoquina ocola*, and *Nyctelius nyctelius* to rice (Bell 1940, Ross and Lambremont 1963), and *Panoquina sylvicola*, *Nyctelius nyctelius*, *Choranthus haitensis*, *Choranthus vitellius*, *Perichares philetetes*, and others to sugarcane (Smyth 1919, Wolcott 1921, Jones and Wolcott 1922, Wolcott 1933, 1936, and Hayward 1943). Hesperiids that have been listed as occasionally injurious to trees include *Epargyreus clarus* and *Erynnis* species (Felt 1918, McDaniel 1933, Craighead 1950, Baker 1972, and Furniss and Carolin 1977). Grass-feeding species such as *Hylephila phyleus* and *Atalopedes campestris* may occasionally damage lawns (Bohart 1947, Warren and Roberts 1956, Ross and Lambremont 1963) and *Calpodes ethlius* frequently will defoliate ornamental cannas (Dyar 1898, Chittenden 1905, 1912, Essig 1926, Weigel and Middleton 1926, and Reinert et al. 1983).

A few skippers accidentally introduced into new areas have become pests. A European species introduced into Canada, *Thymelicus lineola*, is a major pest of pastures and

hay crops (Pengelly 1961, Arthur 1966, and Duchesne and McNeil 1978). Similarly, of two exotic skippers now established in Hawaii, *Hylephila phyleus* causes damage to lawns (Tashiro and Mitchell 1985) and *Erionota thrax* to bananas (Riotte and Uchida 1979).

Aside from human economics, skippers have biological value, being important in the pollination of flowering plants and in the cycling of nutrients and flow of energy in food webs. Since many species are restricted to certain habitats or are very local in distribution, they may also prove useful for biological monitoring of the ecological health of nature reserves or for biodiversity studies.

Skippers also have scientific interest, and a large literature on this group has accumulated over the last few centuries. Many life history descriptions of New World hesperiids have been published, especially by workers in the United States (U. S.), but these accounts sometimes contain errors and are uneven in the choice of characters described. The intent of this study was to investigate the biology of as many U. S. species as possible, compare morphological features of their immature stages, and produce standardized descriptions. This revision will not only serve as a summary of our current knowledge of immature stages of North American Hesperiidae, but will provide a framework for future taxonomic and systematic studies.

CHAPTER 2

METHODS

Study Material

A major problem associated with studying the immature stages of butterflies lies in finding specimens.

Butterflies are relatively rare insects compared to groups such as Diptera, Coleoptera, or Hymenoptera, and locating immatures in the field is often a challenging task.

Although many collectors and researchers are interested in immature stages, few preserve eggs, larvae, or pupae.

Insect collections that contain lepidopteran immatures will often have at least some skipper butterfly larvae, but these are usually common species. Preserved pupae, even of common species, are rare in museum collections. Roy O. Kendall (ROK) has one of the largest (in terms of numbers of individuals as well as species) and best curated collections of North American hesperiids in existence. I borrowed many specimens for study from the Kendall collection as well as from the Florida State Collection of Arthropods (FSCA), Santa Barbara Natural History Museum (SBNHM), United States National Museum (USNM), and the collections of G. R. Ballmer (GRB), T. C. Emmel (TCE), D. H. Habeck (DHH), J. R. Heitzman (JRH), T. L. McCabe (TLM), N. McFarland (NM), and S. Passoa

(SP). Several lepidopterists, including H. D. Baggett, S. S. Borkin, J. F. Emmel, D. W. Hall, D. F. Schweitzer, A. M. Shapiro, and J. R. Slotten, also donated specimens for study. In addition, I have conducted my own field research in California, Colorado, Florida, Georgia, Indiana, Maryland, New Mexico, New York, North Carolina, Pennsylvania, South Carolina, and Texas over the last 20 years. Outside of the United States, I have been able to make collections of hesperiid immatures in Colombia, Costa Rica, Dominican Republic, and the Bahamas. Some tropical species represented in these collections have occasionally been recorded from the U. S. Andrew Atkins and H. Chiba sent preserved immatures of interesting species from Australia and Indonesia, which were useful for making comparative studies.

The number of hesperiid eggs, larvae, and pupae that I examined during the course of this study is presented under the species accounts in Chapter 6 of this work. An identifying label, with the format "MCM-Lot XXXX" (where the X's represent a unique number), was placed in each vial or jar of immatures that I examined. The consecutive numbers used began with 0001 and ended with 1561. The code number was also recorded on an accession form listing specimen deposition, identification, locality, host plant, parasites, number of individuals of each stage, type of container, and preservative. Much of this information was entered into a

digital database using an IBM personal computer and LOTUS 1-2-3 software. The accession code may be used to trace specimens for future studies and was used to link database files together.

Rearing

One method of collecting hesperiid immatures is to search for them in the field. Some species are relatively easy to find with a little practice, since the eggs are laid only on particular plants and the larvae usually fold or tie leaves together to form shelters in which they live. However, many species live such secretive lives that they are best reared in the laboratory.

It has long been known that female butterflies will often lay eggs if confined in a container with the larval host plant. Edwards (1870) got a female zebra swallowtail to lay eggs by placing a nail-keg, from which the bottom had been knocked out, over a pawpaw bush and covering the top with a cloth. Scudder (1870) used tin cans in a similar way and secured eggs of *Thorybes pylades*, *Polites mystic*, and a satyrid butterfly. Both Edwards and Scudder were able to rear many butterflies using this technique. Fletcher (1888) recommended not only caging females over hosts in the field, but also rearing larvae on potted hosts covered by wire cages or glass lamp chimneys. Laurent (1908) found that if female skippers were removed from a cyanide killing jar soon after they succumbed, they could easily be transferred to

individual pill boxes and that they usually recovered without harm in a short time. He then secured eggs from the female skippers by confining them in cages over pots of the host plants.

Caging females with a known or suspected host does not always work. Some species of skippers seem to lay eggs freely, while others absolutely will not oviposit in confinement. Not only is there wide variation between species, there is also much variation between individuals. Generally, a slightly worn female may be more likely to lay eggs than one that is freshly emerged (and perhaps not mated). It has been my experience that pyrgines are less likely to lay eggs in confinement than hesperiines.

Heitzman (1964a) noted that one or two fertile eggs may sometimes be dissected from females that will not otherwise oviposit in captivity.

I have found that females may be transported from the field to the laboratory without harm by placing them individually in the plastic containers in which 35mm film is sold. Either the opaque Kodak or transparent Fuji Film containers work well, but the clear containers have the advantage of the investigator being able to examine the specimens without opening them. Containers with live females should be kept in a cool, dark place such as a field bag or cooler. In the laboratory, the containers may be kept refrigerated for a few days without harm, but it is

best to feed and place the females in oviposition containers as soon as possible. I manually fed female skippers a dilute honey solution (1 part honey to 10 parts tap water) twice a day. By grasping the adult's closed wings with one hand, the skipper's proboscis could be uncoiled into a dish of honey water using an insect pin held by the other hand.

To secure eggs, I found it best to place the females in transparent plastic containers containing small sprigs of host plants. The cut ends of the plants may be placed into small vials of water or wrapped with a piece of wet paper towel to prevent the leaves from wilting. The plant should be flattened against the container wall or arranged such that the butterfly will easily come into contact with the leaves and not become trapped in pockets of vegetation. A hole, 2 to 3cm in diameter, cut into the top of the oviposition container and covered with fine netting, will provide ventilation and prevent condensation.

The behavior of adult skippers in cages consists of periods of rest punctuated by short bursts of activity. The oviposition containers with females and hosts may be placed under incandescent lights to stimulate activity, but need to be monitored frequently, as excessive heat, moisture, or dryness may be a problem. I prefer to place the containers on bright, but not sunny window sills or in a sheltered location out-of-doors where natural light and breezes stimulate the females. Richard Boscoe (pers. comm.)

recommends placing the oviposition containers into closed plastic bags or refrigerating females of species reluctant to oviposit in captivity overnight, but I have had limited success with these techniques.

I have not tried to secure eggs from female *megathymines* in the laboratory. *Megathymus* species glue the eggs to the leaves of yuccas, and the eggs are relatively easy to find in the field at the right time of year. *Agathymus* species either drop the eggs onto the host, or ova laid on the leaves fall off soon after oviposition, making them difficult to find in nature. Comstock and Dammers (1934), Roever (1964), and Stallings and Stallings (1986) were successful in having females of *Agathymus* species oviposit in cages in the laboratory.

Once eggs have been laid, care must be taken to prevent excessive moisture, which promotes the growth of molds, or dryness which may cause the eggs to desiccate. The plastic containers used for securing eggs also worked well for rearing larvae. Ventilation through the screened hole in the lid, fresh food plants, and maintaining clean conditions within the containers were important in the prevention of disease.

Temperate species that undergo larval hibernation pose special problems, as it is often difficult to provide proper environmental conditions in the laboratory. I have had some success in caging larvae out-of-doors on potted plants, or

in rearing the larvae under artificial lights with long-day photoperiods. Other rearing techniques are presented in MacNeill (1964), McFarland (1964), Brown (1965), Kendall (1965), Newcomer (1966), and Tashiro and Mitchell (1985). Wielgus and Wielgus (1973) and Wielgus and Stallings (1974) present methods for rearing *Megathymus* in the laboratory.

Preservation and Preparation

I preserved hesperiid eggs and first instar larvae by placing them in vials with 70% alcohol. Older larvae and pupae were dropped into hot (near boiling) water to kill them (Peterson 1962), blotted dry with paper toweling, then transferred to 2 or 4 dram vials containing 70% alcohol. After several weeks, the old discolored preservative was drained from the vials and new alcohol added. I used 70% isopropyl alcohol for preserving immatures, because it is inexpensive, readily available, and less hazardous than formulations containing acetic acid, formalin, xylene, or kerosene. Specimens preserved in this manner remained relatively pliable and easy to work with, but lost most of the body colors.

To document colors and the general features of living caterpillars and pupae, I made color slides using a Canon A-1 35mm camera with a 100mm macrolens. A 50mm extension tube was used with this apparatus to magnify specimens between 1 and 3 cm in length. Most specimens were photographed in natural light. Both Kodak Kodachrome 64 and Ektachrome 100

color transparency films gave good results, but it was sometimes difficult to get satisfactory slides with the slower film when photographing small specimens under low light conditions.

Descriptive Methods

I chose the checklist by Miller and Brown (1983) as a starting point for my descriptive work. According to these authors, the hesperiid fauna of North America, north of Mexico, contains 1 species of Pyrrhopyginae, 117 species of Pyrginae, 5 species of Heteropterinae, 139 species of Hesperiinae, and 28 species of Megathyminae for a total of 290 species. The Canadian fauna included in this checklist does not contain any species not found in the U. S. (Gregory 1975).

External features of the immature stages were compared with the aid of a Wild M5 stereomicroscope fitted with 20 power eyepieces. A preliminary list of potentially interesting characters was drafted and modified during an initial examination of all of the material. After this review, a new standard character list was produced. The specimens were then examined a second time, new character data were recorded, and drawings of interesting features were made. Abbreviations for segments referred to in the diagnoses are T1-3 for thoracic segments one through three and A1-10 for abdominal segments one through ten.

The fine structure of eggs was observed and photographed using the University of Florida, Department of Zoology scanning electron microscope (SEM) (Hitachi model S-415A). To prevent distortion, the eggs were dehydrated through a series of alcohol solutions (70%-99%). The alcohol was subsequently replaced through a series of acetate solutions. The specimens were then subjected to critical point drying using a Denton Vacuum Inc. Apparatus DCP-1. The dry eggs were glued to SEM stubs and coated with gold-palladium using a Denton Vacuum Inc. Desk-1 Sputterer, then viewed with the SEM.

I made sketches and measurements of structures with a camera lucida attached to the stereomicroscope. The drawing tube allowed for superimposing the image of a metric ruler onto the specimen. Then, by dividing by the magnification power, size could be determined. This method worked well for structures greater than 0.1 mm. The heights and diameters of the eggs of 49 species were measured and recorded using this technique. The lengths of larvae and pupae were made simply with a metric ruler. Measurements of the transverse width of the head and abdominal segment four (generally the widest segment) of larvae, and abdominal segment three (usually the widest) of pupae were made with the microscope. A total of 1584 larvae and 623 pupae of 158 species were measured. For measurements of setal lengths and number of crochets, I chose the largest specimens

available, and these data are reported as maxima in the diagnoses. In comparing pupal abdomen length among the various species of U. S. hesperiids, the distribution of the ratio of A5-8 length and A1-4 length was divided into three equal groups representing short (0.3 to 0.69mm), moderate (0.7 to 0.89mm), and long (0.9 to 1.4mm) classes.

CHAPTER 3

BIOLOGY

Although the larvae of some specialized moths feed on fungi, lower plants (algae, lichens, liverworts, mosses, ferns, cycads, and gymnosperms), other insects, feces, beeswax, or the keratin-containing parts of dead vertebrates, most butterflies feed only on angiosperm plants. Exceptions include a few neotropical nymphalids (Satyrinae) that eat lycopsids (Singer et al. 1971, Singer and Mallet 1986), a few lycaenids and pierids that eat the leaves of pines, and some lycaenids which feed on the leaves of cycads (*Eumaeus* spp.) or are predators of aphids (Liphyinae) or ant larvae (some Polyommatinae). Skippers feed only on angiosperms, but utilize a diversity of plants that are defended by a wide variety of secondary plant compounds.

Species of skippers tend to be stenophagous, limiting the host range to just a few species of plants, yet sixty families of higher plants have been recorded as hosts in the New World. The host relationships of U. S. hesperiids is presented in Table 1. Thirty-one families representing 8 ~~monocot~~ groups and 23 dicots have been reported. Hesperiinae, Heteropterinae, and Megathyminae use only

Table 1. Number of species and subfamilies of U.S. Hesperiidae recorded from various host plant families.

HOST PLANT FAMILY	# SPECIES	HESPERIIDAE SUBFAMILIES
Monocots:		
Agavaceae	28	Megathyminae
Arecaceae	2	Hesperiinae
Cannaceae	1	Hesperiinae
Cyperaceae	15	Hesperiinae
Marantaceae	1	Hesperiinae
Musaceae	1	Hesperiinae
Poaceae	103	Heteropterinae Hesperiinae Pyrginae
Zingiberaceae	1	Hesperiinae
Dicots:		
Amaranthaceae	4	Pyrginae
Aquifoliaceae	1	Pyrginae
Asteraceae	1	Pyrginae
Betulaceae	2	Pyrginae
Chenopodiaceae	8	Pyrginae
Combretaceae	1	Pyrginae
Convolvulaceae	1	Pyrginae
Fabaceae	43	Pyrginae
Fagaceae	9	Pyrginae Pyrrhopyginae
Lamiaceae	1	Pyrginae
Malpighiaceae	4	Pyrginae
Malvaceae	16	Pyrginae
Myristicaceae	1	Pyrginae
Myrtaceae	1	Pyrginae
Ranunculaceae	1	Pyrginae
Rhamnaceae	3	Pyrginae
Rhizophoraceae	1	Pyrginae
Rosaceae	4	Pyrginae
Rutaceae	1	Pyrginae
Salicaceae	1	Pyrginae
Sterculiaceae	2	Pyrginae
Trigoniaceae	1	Pyrginae
Verbenaceae	2	Pyrginae

monocots; Pyrginae and Pyrrhopyginae usually feed only on dicots. Three subfamilies, Hesperiinae, Heteropterinae, and Pyrginae, use Poaceae, while both Pyrginae and Pyrrhopyginae eat Fagaceae.

Hesperiid females adopt a characteristic fluttering type of flight pattern when searching for host plants on which to lay eggs. Often, the females will hover about potential hosts, sometimes landing upon the leaves one or more times, before laying eggs. By closely inspecting leaf shape and sensing plant chemistry, the butterflies are able to distinguish hosts of suitable size, age, quality, and position in the landscape before proceeding to lay their eggs (Scott 1986).

Females usually lay their eggs singly on the leaves of the host plant. Most glue the eggs to the under surface of leaves, while others prefer to oviposit on the upper surface or exhibit no preference. The color of the egg changes as development proceeds. Scudder (1889a) recognized four embryological stages of butterfly eggs. Stage one is of short duration and consists of the newly laid egg, which is of homogeneous color. Stage two is marked by either a darkening of the color or the appearance of small, uniformly distributed spots. During the third stage there is a polarity of the contents corresponding to the formation of the germinal band in which a central annulus and a large lateral spot (the head) appear. In the last stage, the head

moves upward to just underneath the micropyle at the apex of the egg.

The newly laid eggs of skippers may be brownish, pinkish, white, pale yellow, or green. Development of hesperiid eggs agrees with Scudder's (1889a) observations. The eggs soon darken or change color and may develop a reddish ring. Shortly before the eggs are ready to hatch, the dark head of the larva is usually visible at the apex. Skipper eggs typically hatch in 4 to 15 days. When the larva is ready to emerge, it makes a small hole in the chorion with the mandibles, then cuts a circular opening in the apex slightly larger than the head (Ainslie 1922). This process may take several days (Roever 1964), but once the hole is completed, the larva exits quickly. The newly emerged larva usually does not eat the remains of the egg but seeks out a site in which to build a shelter.

Hesperiid larvae tie leaves or parts of leaves together with silk to form characteristic shelters in which they hide when not feeding (Figures 1 and 2). Although skippers are often known as leaf rollers, they do not roll leaves in the manner of tortricids, pyralids, or other moths, but rather fold leaves or tie the edges of several leaves together and line the inside with silk. Among other groups of butterflies, some nymphalids and papilionids construct silk-lined shelters. Those built by charaxines (Nymphalidae) such as *Anaea andria* are the most similar to hesperiid shelters.

Figure 1. Larval shelter of *Urbanus proteus* on *Phaseolus vulgaris* (A), *Polygonus leo* on *Piscidia piscipula* (B) *Erynnis zarucco* on *Sesbania macrocarpa* (C), *Erynnis brizo* on *Quercus myrtifolia* (D), *Wallengrenia otho* on *Paspalum* sp. (E), and *Asbolis capucinus* on *Sabal* sp. (F).

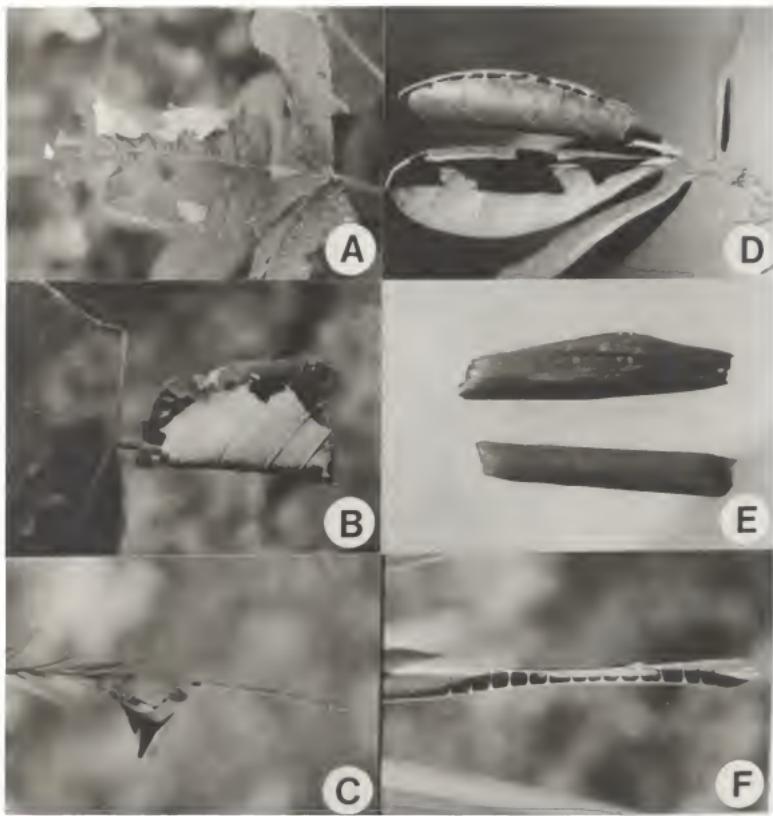
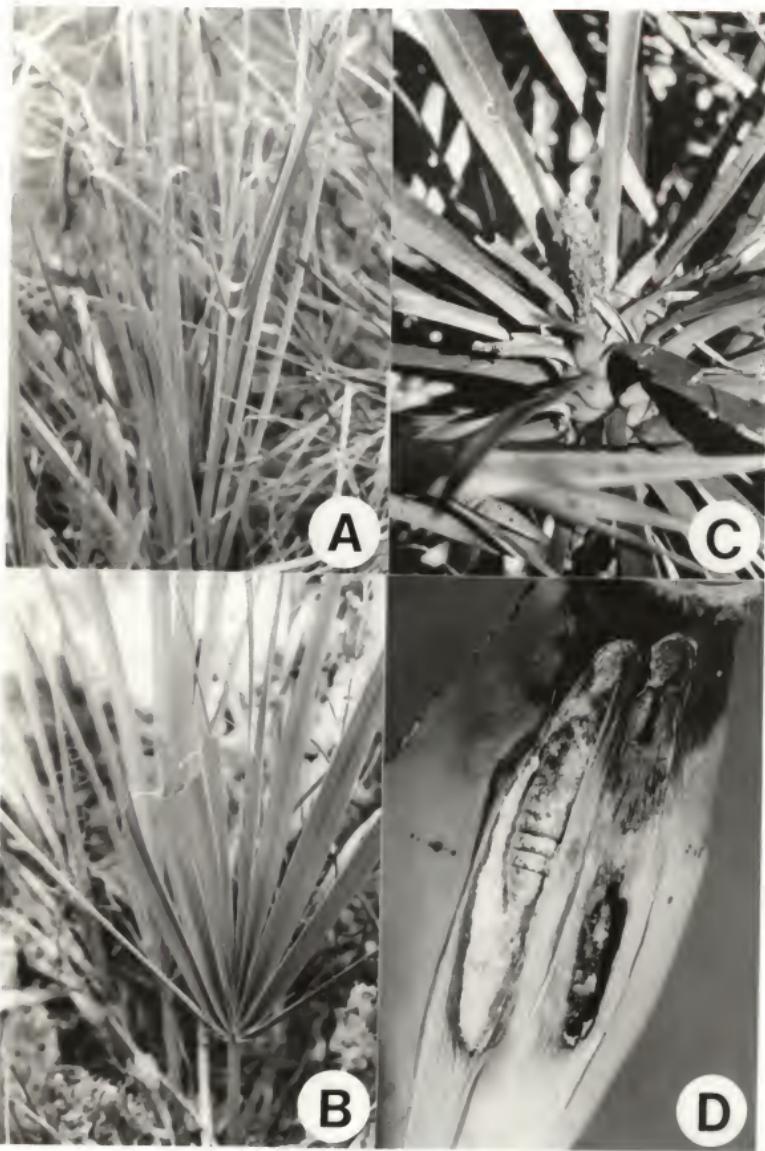


Figure 2. Larval shelter of *Euphyes pilatka* on *Cladium jamaicense* (A), *Euphyes arpa* on *Sabal etonia* (B), *Megathyimus yuccae* on *Yucca aloifolia* (C), and an agave leaf cut open to reveal the tunnels of *Agathymus aryxna* (D).



The only predators that I have observed capturing skipper larvae are *Polistes* wasps. It is not known if hesperiid larvae are palatable to vertebrate predators such as birds and lizards. Parasitic wasps in the families Mymaridae, Eulophidae, and Braconidae frequently attack the eggs and larvae of skippers. The larvae are also commonly attacked by tachinid flies. Potentially, ants, spiders, lizards, birds, and small mammals may eat skipper butterfly immatures unless repulsed by the defenses noted below.

The larval shelters of hesperiids are primarily thought to provide concealment from predators and parasitoids. However, the shelters are often conspicuous, perhaps raising a flag to predators, and skipper larvae are often heavily parasitized. Another plausible reason for shelters may involve chlorophyll. Chlorophyll which becomes uncoupled from the tightly controlled photosynthetic units within plant cells, as during digestion, is capable of diverting electrons to normally inert oxygen molecules, forming highly destructive oxygen radicals (Hendry 1990). Larger herbivores with opaque bodies have little to fear from chlorophyll as the digestion takes place in the dark inside their guts. However, a rare disease of sheep in which partly digested chlorophyll passes into the blood causes cell destruction in epidermal tissues exposed to sunlight due to the formation of activated oxygen (Hendry 1990). Poulton (1894) demonstrated that the ground color of

caterpillars is derived largely from the diet. The green color of hesperiids that feed on leaves is due to chlorophyll. Newly emerged larvae become green only after the first feeding. Hesperiines, which have little cuticular pigmentation, change from green to cream-colored before entering diapause or pupation when they are no longer actively feeding. Leaf-feeding caterpillars which have relatively large amounts of chlorophyll in their blood and guts as well as thin, transparent, or translucent cuticles must have physiological and/or behavioral adaptations that prevent the formation of oxygen radicals. Many authors have noted that skipper larvae hide in shelters during the day and emerge to feed at night (Harris 1862, Lintner 1872, Edwards and Chapman 1879, Panton 1897, Scudder 1889a, and numerous others). In fact, most caterpillars are largely nocturnal feeders (J. Rawlins, pers. comm.). Thus the evolution of shelter-forming behavior in skippers may be grounded in a physiological need for concealment from the sun rather than from predators.

The shelter may also be adaptive in allowing the larva easy access to the leaves of the host. Other caterpillars that do not make shelters or nests rest exposed on the underside of leaves or hide on the branches, under bark, or in leaf litter at the base of the plant. Skipper larvae spin a thin trail of silk with a characteristic side-to-side motion of the head (Fletcher 1889, Scudder 1889a, Ainslie

1922, Clark 1936, MacNeill 1964, McAlpine 1973, and Heitzman and Heitzman 1974) as they move about, allowing for firm footing as well as guidance to feeding sites and shelter location. The caterpillars may change shelters three or four times as they outgrow them, but usually stay on the same host or near the oviposition site. Tamburo and Butcher (1955) found that marked larvae of *Ephyriades brunneus floridensis* mostly stayed at the point of release, but one traveled three host bushes away, or about three meters.

Living in one place for extended periods presents the problem of waste disposal. If frass accumulates near the shelter, it may provide visual or olfactory clues to predators. Skipper larvae propel frass away from the shelter site (Harris 1862, King 1882, Frohawk 1892, Kendall 1965) with the anal comb, sometimes sending the pellets up to a distance of one meter (Scudder 1889a, Ainslie 1922).

Skipper larvae are slow-moving and generally exhibit very subdued behavior. They utilize a variety of defenses against predators, including dropping to the ground and remaining motionless, protective coloration, displaying open jaws, regurgitation of fluids from the mouth, and defecation; they probably also secrete chemicals from a gland on the ventral side of the prothorax (Scott 1986). When disturbed, some notodontid moths, such as *Lochmaeus manteo*, spray a mixture of noxious chemicals from similar glands (Eisner et al. 1972). Although I have handled many

hundreds of skipper larvae, I have never been able to detect any secretions from the prothoracic gland. However, Scudder (1889a) noted that ants turned away (apparently in "great disgust") from the caterpillars of *Epargyreus clarus*.

Coloration is an important adaptation that may involve crypsis, aposematic colors, and disruptive patterns. The heads of the larvae may be all dark, dark with contrasting false eye patches (the "monkey faces" of Seitz 1924 and Moss 1949), dark with pale patches, all pale, or pale with dark stripes or spots. These patterns may deter predators with high visual acuity such as birds or lizards. A predator peering into a folded leaf may see false faces or disruptive patterns that are not recognized as potential prey items or be tricked into interpreting all dark or all pale heads as representing emptiness. Belwood (1990) noted similar color patterns on tube-dwelling neotropical Tettigoniidae, suggesting that these katydids and skippers may have similar selection pressures.

Combinations of cuticular pigments and internally derived colors produce a variety of body colors commonly ranging from dark green to pale blue. Some species are brightly patterned with red, black, yellow, orange, or white cuticular pigments, suggesting that they are unpalatable. Most are greenish with yellow, orange, white, or rarely black lateral lines. Very few have transverse stripes. The dorsum is usually lightly pigmented or transparent,

revealing the pulsating dorsal heart as a dark line. In larger larvae, the male testes often can be seen as two kidney-shaped bodies located toward the dorsum of abdominal segment six. A few species have caudal false face patterns.

For caterpillars to grow larger, they must shed the cuticle. Skipper larvae usually have five larval stages or instars. Temperate species that undergo hibernation may sometimes have a few more stages, especially if reared under laboratory conditions that give confusing signals, such as short days but warm temperatures. The developmental time of the early instars ranges from four days to about a week, but lengthens as the larvae grow larger. The duration of the entire larval period typically ranges from 14 to 45 days.

Shortly before hesperiids molt, the head is withdrawn from the old head capsule and shows as a whitish bulge in the prothoracic area. How this is accomplished has not been investigated, but skippers would seem to have special problems making the withdrawal since a key characteristic of the group is the narrow posterior opening of the head. At the moment of molting, the cuticle separates from the head capsule; then the larva walks out of the old skin which remains fixed to a mat of silk threads by the crochets. The old head capsule is cast away with a few lateral movements of the head, and the larva rests while the new cuticle hardens.

Interestingly, the final larval molt is somewhat different from the others, perhaps because the head of the prepupal organism cannot be withdrawn through the posterior opening of the old head capsule. With a few rhythmic struggles, the larval cuticle splits along the dorsum of the thorax and along the frontal suture of the head capsule which remains attached to the skin (Fyles 1895, Ainslie 1922). The exuvium is then slid backwards to the cremaster, and is pushed aside, lying as a crumpled mass at the far end of the cocoon.

Changes in coloration may occur in skipper larvae upon molting or in preparation for hibernation or pupation. Most species have dark heads during the first two or three instars, but develop other patterns in later stages. Body coloration may also change as the larvae mature. The change in species of *Phocides* is extreme, from red with transverse yellow stripes to white. The body color of temperate species may change from green to brown or take on a pinkish cast without shedding the cuticle before entering hibernation (Minno 1981, Capman 1990). Hesperiines often change from green to a creamy color after they stop feeding and seek out overwintering or pupation sites (Frohawk 1892, Heitzman 1965a). The creamy color is derived from whitish fat bodies and other internal organs which are no longer masked by chlorophyll.

Temperate species of hesperiids usually hibernate as partly grown larvae. More rarely, some species overwinter as fully developed larvae within the eggs (Fyles 1895, Pengelly 1961), first instars (Dethier 1939a), last instar larvae (Riley 1876a, Edwards 1885a, Heitzman and Heitzman 1974), or pupae (Scott 1981). After winter has passed, non-mature larvae emerge from their hibernaculae and resume feeding. Those that overwintered as mature larvae (*Erynnis* and *Megathymus* species) usually do not feed in the spring, but pupate as directed by environmental cues and soon emerge as adults. Thus species with a pupal or mature larval diapause are among the first to emerge as adults during the spring. Species adapted to temperate climates are generally univoltine or bivoltine, whereas tropical skippers often have three or more generations per year.

Unlike most other butterflies, skippers usually pupate in sealed cocoons. The pupa is supported by a silk thread about the junction of the thorax and abdomen, and is anchored to the substrate by cremaster hooks entangled in a small transverse thread or a pad of silk. The cocoon may be formed by sealing the last larval shelter, or the caterpillar may seek out another nearby site. Scudder (1889a) found *Epargyreus clarus* pupae under boards, shingles, and rubbish under some large locust trees. Temperate species seem more likely to pupate in leaf litter than tropical species.

The pupae of many species are coated with a white or bluish-white wax which is easily rubbed off with a probe or a finger. In some, the wax is a delicate bloom while others are densely coated. Moss (1949) thought that the wax may help keep off moisture while also deceiving predators with the appearance of a cadaver covered with mold. Another protective coloration of the pupa involves the thoracic spiracles, each of which is shielded by a conspicuous cuticular rise. When viewed from the front, these structures become eyes and other features of the head give the appearance of a small animal.

Although most, if not all, skippers secrete at least some wax through pores in the pupal cuticle; a few groups also produce quantities of wax in the larval stage. Late in the last instar, many hesperiines and megathymines produce wax from glands concentrated in patches on the ventral side of the body. These deposits have a characteristic shape and distribution that often vary between genera. Within a genus, some species may have wax glands, while other congeners do not. The hollow filaments of wax that issue from the glands (Locke 1960) have a flaky or cottony appearance. The larva uses the wax to coat the inside or plug the entrance to the pupal chamber.

Biology of the Pyrrhopyginae

Little is known of the biology of the Pyrrhopyginae. I have examined a few preserved larvae of *Pyrrhopyge araxes arizonae*, *Pyrrhopyge chalybea*, and an unidentified Brazilian species, but have not had the opportunity to study living material. Host plants include members of the Anacardiaceae, Anonaceae, Clusiaceae, Fagaceae, Flacourtiaceae, Lauraceae, Meliaceae, Myristicaceae, Myrtaceae, Sapindaceae, and Sterculiaceae. The larvae live in pyrgine-type shelters of folded leaves (Moss 1949, Burns 1964a). Larvae described by Moss (1949) and Comstock (1956b) have a reddish ground color and contrastingly colored transverse stripes or spots and some resemble the pyrgine genus *Phocides*. Pupae are also reddish but are covered with white wax in the manner of many pyrgines. The last shelter of *Myscelus pardalina* was perforated by a few large holes (Moss 1949), a specialized behavior of certain pyrgines such as *Quadrus* species. Pupation takes place in the last larval shelter or in leaves on ground. Moss notes that *Pyrrhopyge* larvae are very pugnacious when disturbed and often leave the shelter when it is cut from the host.

Biology of the Pyrginae

As Scudder (1875) noted, members of the Pyrginae usually feed on dicotyledonous plants. Many pyrgines eat legumes (Fabaceae). However, there has also been a tremendous radiation away from the use of legumes such that

at least 44 other families of plants are eaten by New World pyrgines. Many of these hosts contain strongly scented secondary plant chemicals. Remarkably, there are also a few species of *Urbanus* that feed on grasses (monocots), while their congeners eat legumes (Kendall 1976)! Twenty-four plant families are utilized by pyrgines reported from the U. S. (Table 1).

Female pyrgines usually lay eggs singly on living leaves of the host but may also choose flower buds, stems, fruit, or dead leaves (Panton 1897, Tamburo and Butcher 1955, Minno 1981). *Pholisora catullus* deposits eggs on the upper side of the leaf near the midrib (Edwards 1884, Capman 1990), but most other species seem to prefer the edges of the lower surface. *Urbanus dorantes* frequently oviposits on the inflorescences of *Desmodium* species in Florida. One pyrgine, *Epargyreus clarus*, has been observed to lay eggs on nearby plants after inspecting and touching the true host (Opler and Krizek 1984, MCM observation). Newly laid eggs may be white, yellow, pale green, or brownish.

Urbanus proteus and *Autochton cellus* females lay stacks of eggs containing from two to six individuals (Comstock 1881, Quaintance 1898, Clark 1934, 1936). The eggs in the stack are offset at an angle (Clark 1936), allowing larvae in the lower eggs to emerge in the normal way from the exposed micropylar area. Quaintance (1898) noted that the most distal egg in the string is the first to hatch.

Although these species begin life communally, the newly hatched larvae lead separate lives, each constructing a shelter around the margin of the leaf. Kendall (1976) reported finding ten larvae of *Codatractus hyster* in a single shelter and this may be a truly gregarious species.

First instar larvae usually have dark brown or black heads. However, some *Erynnis* species have pale head capsules. Newly emerged pyrgine larvae do not eat the remains of the egg, but usually seek out the margin of a leaf and begin constructing a shelter. The larva eats two converging slits into the leaf margin, except for a narrow portion which acts as a hinge. The resulting flap is then folded over and secured with three or four strands of silk (Lintner 1872, Edwards 1885b, Panton 1897, Quaintance 1898, Hayward 1927a, Clark 1936) in such a way as to form a dome-shaped roof. The inside of the shelter is lined with silk. Clark (1934) described the shelters of *Autochton cellus* as limpet-like. Most species fold the flap over onto the upper surface of the leaf, but *Zestusa dorus*, *Paches polla*, and *Atarnes sallaei* tie the flaps to the underside (Klots 1971, Kendall and McGuire 1975, Kendall 1976).

Erynnis species that feed on woody plants often construct their shelters where a vein reaches the margin (Kendall and McGuire 1975) or at the tip of the leaf (Kendall 1965). The vein adds strength to the hinge. Rather than cutting into the leaf margin, the first instar

larva of *Nisoniades bessus godma* eats a circular channel near the center of a leaf then ties the flap over (Kendall 1976). Newly emerged larvae of *Helioptetes laviana* eat away the leaf surface, then fold a flap over the weakened spot (Kendall 1965). Young *Pyrgus* species usually seek out deep wrinkles or overlapping leaves in which to build shelters (Panton 1897, Minno 1981) and *Pyrgus scriptura* clips off the dense stellate hairs of the host and ties them together with silk to form a covering (Minno 1981). The young larva of *Urbanus procne* forms a "lean-to" shelter by eating away part of a blade of grass so that the terminal end can be pulled over about 85 degrees, but older larvae simply hide in the detritus at the base of the plant (Kendall 1976).

Older pyrgine larvae may make more box-like shelters by eating channels perpendicular to the leaf margin and folding the rectangular flap over (Clark 1936, Edwards 1885a) or tie the edges of one or more leaves together. *Helioptetes macaira* may hide in the flower bracts or in dead leaves on the plant or the ground, but often fastens two leaves together, then cuts the petiole of the one which is to be the roof, which withers and dies (Kendall 1965). Similarly, *Pyrgus communis* often uses a living leaf and detritus (Dethier 1944b, Minno 1981). A few species such as *Erynnis persius*, *Atarnes sallaei*, and *Quadrus* species eat small holes in the shelter, then web them over with silk (Scudder 1889a, Kendall 1976, and Young 1991). Before moving to a larger

shelter, pyrgine larvae clip the silk threads holding the flap (Scudder 1889a, Clark 1936). *Autochton cellus* usually makes the first shelter toward the middle or tip of a leaflet and the second more toward the base (Clark 1936).

Pyrgine larvae sometimes construct shelters on plants that are not eaten, but are physically near the true host. Clark (1936) found *A. cellus* shelters on hickory, sassafras, and grape near to the true host (*Amphicarpa bracteata*,) and I have found shelters of the legume-feeding *U. proteus* on blackberry and oak leaves. One fourth instar *U. proteus* larva, which I placed on a potted *Desmodium incanum*, built a shelter on a small potted guava adjacent to the host. This behavior suggests that some predators may first direct their hunting toward the food plant rather than the caterpillar.

Pyrgine larvae usually feed on the edges of leaves near to the shelter. Scudder (1889a) noted that the first instar larvae of *Erynnis persius* feed on the surface layers of the host leaves. Similarly, *Pyrgus scriptura* larvae feed on the leaf surface within the shelter, rather than the edges of leaves. A few species such as *Helioptetes ericetorum* and *Staphylus hayhurstii* may eat holes in the leaves (Coolidge 1923, Heitzman 1963). Young larvae prefer young tender leaves, but older caterpillars are often able to feed on tougher mature foliage.

Small larvae tend to rest on the top of the shelter in an inverted position (Clark 1936, Kendall 1965). Pyrgine

shelters are usually more circular than linear, at least during the early instars, and some species (*Achalarus lyciades* and *Helioptetes ericetorum*) assume a coiled resting position, with the head and tail facing the same direction in this unrestricted space (Scudder 1889a, Coolidge 1923).

When disturbed, pyrgine larvae use several defensive behaviors in order to protect themselves. Most will turn the head toward the direction of the stimulus with open jaws, and attempt to bite or thrash the head from side to side. Scudder (1889a) noted that *Erynnis juvenalis* scrapes the open jaws backwards on the surface of the leaf, making a scratching sound. While they may appear ferocious, I have never actually been bitten by a pyrgine larva. They usually thrash briefly if picked up with fingers, and some such as *U. proteus*, *E. clarus*, and *A. cellus* spit out a watery green-colored fluid if greatly harassed (Scudder 1889a, Clark 1936, MCM observation). Kendall (1976) observed *Urbanus teleus*, a grass-feeder, to fall to the ground upon being disturbed and lie motionless for long periods of time in the manner of some hesperiines.

The larval stage typically lasts from 15 to 30 days for most pyrgines that do not have diapause requirements. Temperate species usually pass the winter as partly or fully grown larvae; thus for these skippers, the larval stage may extend over several months. A few species diapause as

pupae. I do not know of any pyrgines that overwinter as eggs or first instar larvae.

Most pyrgines pupate in cocoons fashioned from the last larval shelter or spun in detritus and debris on the ground. Kendall (1965) noted that although *Cogia outis* usually pupates on the ground, one larva burrowed under the soil surface and pupated in a silk-lined chamber. Within the cocoon, the pupa is supported by a silk girdle about the middle and is attached to silk threads by the cremaster hooks at the caudal end. Many other butterfly families and some moths use this arrangement, but pyrgines have a specialized feature not known in any other group. The silk girdle supporting the middle of the body also has a median attachment to the cocoon. Thus if the ventral surface of the pupa is toward the bottom of the page, the shape of the girdle is of an inverted letter "Y" (Forbes 1923). Similarly, the cremaster attachment may be Y-shaped (Coolidge 1923).

The pupae of pyrgines may be opaque dark brown, or greenish with dark markings on the dorsum and wing cases. A few have a short peg-like horn on the frons. The pupae of many pyrgines are thickly coated with wax. The cephalic end of the body is frequently modified to give the appearance of a larger animal with staring eyes. Clark (1936) likened the *Autochton cellus* pupa to the head of a manatee when viewed

from the front. Moss (1926) and Box (1928) describe the frightening appearance of *Bungalotis* pupae.

Biology of the Heteropterinae

Not much is known of the biology of the Heteropterinae, except for the Arctic Skipper, *Carterocephalus palaemon* (Fletcher 1889, Frohawk 1892). The morphology, coloration, and behavior of the immature stages of this species are closely similar to that of the Hesperiinae.

Biology of the Hesperiinae

Unlike the pyrgines, Hesperiinae feed on monocots (Scudder 1875). Most New World hesperiines eat grasses (Poaceae), sedges (Cyperaceae), and palms (Arecaceae), but some also feed on the leaves of Bromeliaceae, Cannaceae, Liliaceae, Marantaceae, Musaceae, Orchidaceae, and Zingiberaceae. Host plants of hesperiines recorded from the U. S. include 8 families of monocots (Table 1).

Hesperiine females usually glue the eggs singly to the leaves of the host. Although most hesperiines prefer to deposit their eggs directly on the larval food plant, *Hesperia* species, *Polites* species, *Wallengrenia otho*, *Atalopedes campestris*, *Ochodes yuma*, *Poanes hobomok*, *Lerodea eufala*, and *Panoquina panoquinoides* will sometimes lay eggs on dicots or other substrates near the larval host plant (Scott 1986). On two occasions, I have observed *Polites vibex*, a grass feeder, to lay eggs on dicots after fluttering closely over patches of grass. However, I have

also seen females of this species oviposit directly on grass on several occasions. Some populations of *Hesperia lindseyi* oviposit on lichens growing on fence posts and trees near the grass on which the larvae feed (MacNeill 1964). Dana (1981) discovered that *Hesperia ottoe* in southwestern Minnesota oviposits on the disk flowers of pale purple coneflower (*Echinacea pallida*), an adult nectar plant that is not eaten by cattle. After eclosion, the young larvae of these hesperiines must wander, sometimes over relatively long distances, to find a host and begin feeding.

Although the introduced skipper, *Thymelicus lineola*, always lays eggs in rows inside the sheaths of grasses, there are no known New World hesperiines that consistently lay clusters of eggs. Some such as *Calpodes ethlius* and *Problema byssus* may haphazardly deposit eggs in small clusters on occasion (Chittenden 1912, MCM observation). The eggs are usually white or green, but a few species have yellow or pinkish eggs. Green or yellowish eggs frequently develop a bright red ring and apical spot after a few days (Dethier 1942e, Heitzman 1964a, 1966, Brown and McGuire 1983, MCM observation).

The newly emerged larvae of many hesperiines first eat the remains of the egg, leaving only the shiny circular base, before building a shelter (Fyles 1895, Chittenden 1905, Ainslie 1922, Coolidge 1922, 1925, Dethier 1942d, Nielsen 1958, Heitzman 1964b, 1965a, 1966, Heitzman and

Heitzman 1970b, MCM observation). Shelters are often formed at the tip of a leaf by tying the edges together with silk or by eating a slit part way into the leaf and folding over the flap. Depending upon the species, the flap may be folded onto the upper or the lower surface of the leaf. Some hesperiines, such as *Euphyes* species and *Atrytonopsis hianna*, tie the tips of two overlapping leaves together (Heitzman and Heitzman 1974, MCM observation). *Calpodes ethlius* cuts two slits parallel to the leaf margin and folds the flap over.

Older larvae typically live in tubular shelters formed by tying the edges of several leaves together and lining the inside with silk. The distal end of the shelter may be tightly closed. *Lerema accius* feeds below the shelter, nearly severing the midvein, so that the shelter dangles down from the cut. The older larvae of *Asbolis capucinus* fold the edges of a palm leaflet under and eat the leaf tissue near the tip, except for the midrib, which protrudes like a long spine. *Wallengrenia* species are most unusual in that they form a case from a piece of leaf. They drag the case to feeding sites, temporarily attaching it to the host with silk (Kendall 1960, MCM observations).

Although most hesperiines tend to live upon the leaves of the host, *Hesperia* species and their relatives usually construct horizontal shelters of silk and detritus near the base of the plant. Sometimes the shelters may extend below

ground (Cockayne 1952, MacNeill 1964, Heitzman and Heitzman 1970b). McCabe and Post (1977) found larvae of *Hesperia comma assiniboia* in silk-lined burrows under dried cattle droppings. Older larvae of a few hesperiines such as *Panoquina* species, *Nastraea* species, *Oarisma powesheik*, *Pompeius pompeius*, and *Decinea perciosius*, do not make shelters, but rest exposed on leaves or hide in natural recesses (Dyar 1892, McAlpine 1973, Kendall 1976, Kendall and Rickard 1976, MCM observations). Although Kendall (1966b) mentioned that *Poanes viator* does not make a shelter, I have found older larvae in typical shelters as well as in recesses at the bases of the leaves in Alachua County, Florida. As Shapiro (1971) noted, the larva usually reinforces the recess with some silk.

First instar larvae of hesperiines usually have a dark head. The only exception that I have observed is *Poanes viator* which has a cream-colored head with some small dark spots. Species that live on leaves are mostly green with longitudinal stripes or reticulate patterns of white or pale yellow. The head capsule frequently bears dark stripes or spots on a pale ground. Hesperiines that live near the ground surface are dullly colored brown or dark green and have heads that are plain black or black with pale patches.

For some species, the caudal end may be modified to provide a defense from predators. During the act of defecation, the larva must expose the terminalia which may

attract the attention of lizards or other predators. Some hesperiines (such as *Atrytone delaware* and *Asbolis capucinus*) have a flattened, pale-colored suranal plate rimmed or patterned with black. In addition, the last pair of spiracles is often black, contrasting with the pale body color. When viewed from behind, the spiracles become eyes and the suranal plate a broad bill.

Many hesperiines, especially those that do not build shelters, rest with head flattened ventrally against the substrate and the mouth protracted forward (Forbes 1960, MCM observation). Although most hesperiine larvae will rapidly retreat into the shelter if threatened, they tend to be relatively docile. When disturbed, they may drop from the plant, curl ventrally, and remain motionless for a long time (Panton 1897, Heitzman 1964a, MacNeill 1964, Heitzman and Heitzman 1970b). *Hesperia* species and *Amblyscirtes belli* thrash violently within the shelter if disturbed (MacNeill 1964, Heitzman 1965b).

Hesperiines that diapause during the winter usually do so as partly grown larvae (Scott 1981). Less commonly, they may pass the winter as fully developed larvae within the eggs, first instar larvae, last instar larvae, or pupae. Although some species may complete the larval stage in about two weeks (Comstock and Dammers 1931, Kendall 1965), one month or longer is more typical. During the last instar

many species develop ventral wax glands on the abdominal segments.

Like the pyrgines, hesperiines usually pupate in sealed cocoons. However, *Lerema accius* and *Cymaenes tripunctus* pupate exposed, but under a leaf with the edges slightly drawn together. *Panoquina panoquin* pupates exposed on the upperside of leaves. *Amblyscirtes belli*, *Niconiades nikko*, and *Quinta cannae* cut the last shelter from the host and form the cocoon on the ground (Kendall and McGuire 1975).

Hesperiine pupae are supported by a simple silk girdle about the middle and are attached to a pad of silk by the cremaster. Species of *Atrytone* and *Euphyes* lack these supports and pupate loosely in the cocoon in a vertical position. The cremaster of these species is modified into one or two spines and lacks hooks.

The pupal cuticle of hesperiines tends to be lightly pigmented and thin. Those that pupate exposed are pale green and may have yellow or white stripes on the abdomen. Most have a cream colored or slightly greenish ground color with dark patches or lines on the head, wing cases, and dorsum. Some groups of hesperiines have an elongate point on the frons of the pupa (a "beak") that may be upturned or T-shaped at the tip. *Atrytone delaware* and *Poanes viator* have a bulbous frons reminiscent of the Australian Trapezitinae, some of which are wildly modified into false face patterns resembling the jaws of termite soldiers. As

development proceeds, the eyes become reddish, the wings darken, and just before emergence the adult is clearly visible through the transparent cuticle.

When the adult emerges, the pupa splits along the dorsum of the thorax, the edges of the head, and the costal margin of the wing cases. The pupal cap (the cuticle covering of the head) is often torn away completely. The exuvium frequently contains a clear or yellowish meconium, which is expelled during emergence (Panton 1897, MCM observation).

Biology of the Megathyminae

I have closely observed the biology of *Megathymus yuccae* and *Megathymus cofaqui* in Florida, but have no experience with other Megathyminae. Fortunately, there is a large literature base available on this interesting group. Riley (1876a,b, 1877), Freeman (1951a), Tinkham (1954), Remington (1959), Roever (1964), and Wielgus and Stallings (1974) provided much of the summarized information presented below. Not only do the Megathyminae have a highly specialized biology that differs considerably from other skippers, but the three tribes within this subfamily have each evolved their own peculiar specializations.

Megathymines feed only on plants in the Agavaceae. *Megathymus* species feed in the stem and roots of yuccas. Members of the closely related genus *Stallingsia* bore into the stem of *Polianthes* species. Although *Yucca* species have

large, starchy roots, they also contain saponins and some are commonly known as soap plant. The sap of many yuccas and agaves is highly irritating to human skin and causes a severe poison ivy-like dermatitis. The specialized host preferences of many megathymines seems due, in part, to female choice, as the larvae of *Megathymus yuccae* can be reared in the laboratory on starchy roots of quite different chemistry such as potatoes.

Megathymus species (Megathymini) glue their eggs singly to the leaves of the host but sometimes select nearby dead leaves or other plants (Riley 1876a,b, 1877, MCM observation). Females often select small or isolated plants in favor of those that are more robust or clumped (Oslar 1900, Tinkham 1954, Stallings and Turner 1956, Remington 1959, McCabe and Post 1977). The eggs are greenish when first laid but later turn white, brownish, or pinkish. They hatch in 7 to 16 days (Wielgus and Stallings 1974).

Newly emerged larvae are reddish. The remains of the egg are not eaten. The young larva of *Megathymus yuccae* usually constructs a covering of silk and plant fibers over itself near the tip of a leaf and feeds on the epidermal tissue. Later, the larva ties together the youngest leaves at the center of the plant, then bores into the stem. Most other *Megathymus* species bore directly into the stem after emerging from the egg.

Unlike other skippers, larvae of *Megathymus* species make a cigar-shaped "tent" of silk, plant fibers, and detritus. Some species such as *M. yuccae* make the tent when they begin boring into the stem. As the larva grows, the tent is enlarged, and may be seven or eight centimeters long by pupation time. All during the feeding period, frass is expelled from the tip of the tent, but rather than being propelled away, the pellets are simply dropped from the opening.

Megathymus streckeri and *Megathymus cofaqui* are somewhat different in larval behavior. These species bore directly into the stem after emerging from the egg, and pack the frass behind as they feed. When ready to pupate, the larvae burrow from the roots upward through the soil and make a short tent of silk, detritus, and soil.

Mature larvae of *Megathymus* species are brownish or cream-colored with reddish brown or black heads. Wax glands on the ventral side of abdominal segments 7 and 8 supply copious quantities of wax to line the tunnel. Overwintering occurs in the larval stages. *Megathymus yuccae* hibernates as a mature larva and pupates in the spring without further feeding.

The tunnels may extend several feet into the stem and roots of the plant and although the terminal bud is killed, the damage done by the larva usually has a pruning effect, causing the plant to produce new shoots (Remington 1959).

Large species such as *Megathymus ursus* may inflict enough damage to kill the host (Stallings and Turner 1956).

The pupae of *Megathymus* species are brown and lack silk supports. The tip of the abdomen is freely movable, allowing the pupa to move up and down in the tunnel. When disturbed, they quickly retreat to the bottom of the burrow. Before emergence, they usually position themselves just below the tent. Tinkham (1954) speculated that these movements may serve to regulate temperature as well as retreat from disturbances. *Megathymus* larvae defend themselves by biting with the jaws, locking themselves in the burrow, defecating, and expelling a brownish fluid from the mouth (Wielgus and Stallings 1974).

After the adult emerges, it crawls upward and pushes its way through the loosely sealed opening to the tent. A yellowish meconium is expelled into the pupal exuvium. The adult usually perches on the tent while expanding and drying the wings. *Megathymus* species have only one or two generations per year, depending on the species.

Aegiale hesperiarius (Aegialini) and *Agathymus* species (Agathymini) feed only on century plants (*Agave* species). *Aegiale hesperiarius* glues small clusters of eggs to the host leaves (Dampf 1924). *Agathymus* species either perch on the host or nearby and drop or flick the eggs haphazardly (Comstock and Dammers 1934, Freeman 1951a) or lay the eggs on a host leaf. However, since no adhesive is applied, the

eggs fall to the ground (Roever 1964). Stallings et al. (1985) noted that females of *Agathymus estelleae* dropped between five and ten eggs at one time. Egg color changes from green to reddish in *Agathymus* species (Comstock and Dammers 1934, Roever 1975). One species, *Agathymus estelleae*, produces a range of egg colors varying from green to beige to pinkish (Stallings and Stallings 1986). The duration of the egg stage is from 22 to 52 days (Roever 1964).

Newly emerged larvae do not eat the remains of the egg, but crawl toward the distal half of a leaf and make a short burrow directed toward the tip (Roever 1964). *Agathymus* larvae spin a trail of silk when moving about on the leaf surface. The burrow is also lined with silk to prevent sap from entering, which is not always successful, forcing the larva to move to another site or another plant. The frass produced by young larvae is relatively dry and green (Roever 1964).

After several molts, the larva passes the winter within the burrow, then moves to the base of the leaf and makes a new tunnel directed toward the stem. This tunnel is also lined with silk except at the distal end, where the larva feeds primarily on sap. The entrance may be on the upper side, lower side or either surface of the leaf, depending upon the species. Defecation occurs at the tunnel entrance, after which the entry is partially barred by a few strands

of silk. The oily, dark brown frass accumulates around the entrance to the tunnel during the summer feeding period.

Aegiale hesperiariis, *Agathymus evansi*, and *Agathymus stephensi* cause harm to the plant, as evidenced by necrotic tissue near the point of entry.

Agathymus larvae have dark heads and greenish or bluish white bodies. When feeding is completed, the entire tunnel is lined with silk and powdered with wax, except for *Aegiale hesperiariis* and *Turnerina hazelae*, which do not develop wax glands. Instead of constructing a tent over the tunnel entrance as do *Megathymus*, *Agathymus* exude a pliable silk from the mouth and fashion it into an opaque finger nail-like door. The silk door completely seals the tunnel entrance.

Pupation occurs in the bottom of the tunnel. The brown pupa is not supported by silk and is oriented with the head toward the entry. At the time of emergence, the adult crawls from the exuvium and pushes on the trap door, which swings open on a hinge along the bottom edge. The adult then exits the tunnel, expands and dries the wings, and flies away.

CHAPTER 4
GENERAL MORPHOLOGY

This chapter describes external morphological characteristics of the eggs, larvae, and pupae of U. S. skippers. Many structures exhibit a wide range of variation between the various species. Morphological variation is further noted in the species diagnoses of Chapter 5.

Eggs

The eggs of hesperiids found within the U. S. vary from 0.4 to 1.8mm in height and 0.6 to 3mm in diameter. Hesperiid eggs are wider than high. Shape varies from hemispherical (vertical sides) to somewhat conical (sloping sides) (Figure 3). Numerous minute holes (aeropyles) occur on the surface of the chorion. The micropylar area at the top of the egg is surrounded by rosette patterns of sculpturing (Figure 4). Scudder (1875) first noted that the sculpturing of hesperiid eggs seemed to vary consistently between subfamilies. Pyrgines have ribbed eggs (Figure 3) while hesperiines have smooth eggs or eggs with polygonal patterns of sculpturing (Figure 5). While this pattern generally holds true, some Pyrginae, such as *Cogia outis*, have polygonal sculpturing. Other pyrgines have vertical rows of short spines. Megathymines, like hesperiines, have

non-ribbed eggs with polygonal sculpturing patterns.

Heteropterine eggs are described as having vertical grooves (Higgins 1975); however, a *Butleria* species has ribbed eggs (Herrera et al. 1991), and the egg of *Carterocephalus palaemon* is smooth with polygonal sculpturing (Brooks and Knight 1982). I could not find specimens, detailed descriptions, or illustrations of pyrrhopygine eggs.

Larvae

Hesperiid larvae, like the caterpillars of other lepidopterans, have a head, three thoracic segments, and ten abdominal segments. Each thoracic segment bears a segmented pair of legs. In addition, abdominal segments three through six and ten each have a pair of unsegmented prolegs.

Spiracles are located on the prothorax and abdominal segments one through eight. The spiracles on the prothorax and abdominal segment eight are usually slightly larger than the others. The body segmentation of hesperiids tends to be ill defined and confused by folds or wrinkles of the cuticle (annuli or plicae).

Mature larvae of U. S. hesperiids range in length from 8 to 86mm. The prothorax is larger than the head in *Megathyminae*, about the same size as the head in *Pyrrhopyginae*, and generally smaller than the head in the *Pyrginae* and *Hesperiinae*. Body width tends to be more or less uniform. However, the thorax of *Megathymus* species is slightly enlarged. These plant boring larvae are able to

expand the thoracic region and thereby lock themselves into their tunnels upon being disturbed by a predator or human observer. Other Megathyminae are somewhat wider in the area of abdominal segments three to five. The transverse width of the U. S. hesperiids varies from 1.6 to 11.7mm. Hesperiines tend to be more slender than pyrgines.

The setae occurring on skipper larvae exhibit variation in shape (Figure 6). Although simple setae are the most abundant type, some species also have modified setae. Modified setae vary in the shape of the tip, which may be blunt, slightly expanded, or greatly expanded. Pyrgines and some hesperiines frequently have setae with expanded tips. Branching setae are another modified type found only on the head of certain pyrgines.

The length of the setae on the body and head varies between species. On an individual caterpillar, the setae are usually longest toward the ventral side of the body and shortest on the dorsum. The length of the setae on the dorsum of abdominal segment four varies from < 0.1 to 6.4mm for U. S. species. On the head, setae range from < 0.1 to 5mm near the apex to 0.1 to 5.7 on the ventral side.

Pyrrhopygines have very long setae. Most other hesperiids have short or very short setae, but a few pyrgines and hesperiines have long or moderately long setae.

Lenticles are small sclerotized plates that seem to represent modified setae. Franzl *et al.* (1984) found the

lenticles of *Calpodes ethlius* to be innervated secretory structures that probably produce lipids. The positions of the lenticles change with each larval molt (Franzl et al. 1984), alternating between two basic patterns. The expression of lenticles at a particular location may not always occur or they may be present in excess. Not only is there variation between individuals, the number of lenticles often varies from side to side of a single larva. Several larvae usually need to be examined in order to determine the pattern for a particular species. A generalized map of lenticle distribution is presented in Figure 7. Table 2 lists the maximum number of lenticles observed in the present study at eight positions on the prothorax, five positions on thoracic segments two, three, and abdominal segments one through nine, and two positions on abdominal segment ten for subfamilies Pyrrhopyginae, Pyrginae, Heteropterinae, and Hesperiinae. Megathymines also have lenticles, but usually in a supraspiracular cluster or in small groups on the ventral side of abdominal segments one, two, seven, or eight (Figure 8). Table 3 presents the number of lenticles present on ten megathymin taxa.

Pigments that may be present in the cuticle of hesperiid larvae are red, yellow, orange, white, or rarely black. Unfortunately, most of these pigments are destroyed in preserved larvae. Literature descriptions are often unreliable as they may refer to wax deposits, cuticular

Table 2. Maximum number of lenticles observed per segment and position on Hesperiidae larvae in the present study. Lenticles may be found in eight possible positions on the prothorax (T1), five positions on thoracic segments 2-3 and abdominal segments 1-9, and two positions on the last segment (A10). An asterisk indicates 10 to 15 lenticles present.

SPECIES	MAXIMUM # LENTICLES PER POSITION					
	T1	T2-3	A1-2	A3-6	A7-9	A10
	12345678	12345	12345	12345	12345	12
PYRRHOPYGINAE:						
<i>P. araxes</i>	10001010	00100	00114	10120	00122	10
PYRGINAE:						
<i>P. pigmalion</i>	10001020	01010	10112	10110	00110	01
<i>P. palemon</i>	10001140	01120	10110	10110	10110	01
<i>E. zestos</i>	10001120	11110	10111	10121	10111	10
<i>E. clarus</i>	10001120	10100	10111	10021	10111	11
<i>E. exadeus</i>	10001120	11014	10111	10111	10111	10
<i>P. leo</i>	10001130	1300*	10111	10111	10111	11
<i>C. catillus</i>	10001120	11000	10111	10111	10011	11
<i>T. undulatus</i>	10001020	10014	10021	10021	10021	01
<i>P. mexicanus</i>	10100213	1110*	10111	10122	10121	11
<i>P. procerus</i>	10001244	1210*	10112	10113	10111	11
<i>C. alcaeus</i>	10001020	11100	10113	10122	10122	11
<i>C. arizonensis</i>	10001020	01100	10113	10113	10112	11
<i>U. proteus</i>	10001120	11000	10111	10111	10111	11
<i>U. esmeraldus</i>	10001120	11100	10022	10121	10011	11
<i>U. dorantes</i>	10001120	11100	10111	10111	10111	11
<i>U. teleus</i>	10001122	01003	10111	10112	10112	01
<i>U. procne</i>	10001110	11110	10011	10111	10111	11
<i>A. fulgerator</i>	10001120	11100	10121	10121	10121	11
<i>A. gilberti</i>	10001120	01000	10121	10121	10121	11
<i>A. anaphus</i>	10001120	01000	10121	10121	10111	11
<i>A. cellus</i>	10001120	11100	10121	10121	10121	11
<i>A. lyciades</i>	10001120	11000	10011	10011	10011	11
<i>A. casica</i>	10001120	11000	10111	10111	10111	11
<i>T. bathyllus</i>	10001120	01110	10111	10111	10111	11
<i>T. pylades</i>	10001120	12113	10112	10111	10112	11
<i>T. diversus</i>	10000120	01000	10011	10111	10111	11
<i>T. mexicanus</i>	10001100	01000	00011	10011	10111	10
<i>T. confusis</i>	10001122	12104	10111	10111	10111	11
<i>T. drusius</i>	10001121	11012	10111	10111	10111	11
<i>C. potrillo</i>	10001020	11000	10111	10111	10111	11
<i>C. hippalus</i>	10001020	10000	10011	10011	10012	01
<i>C. outis</i>	10101020	10002	10012	10122	10012	01
<i>C. caicus</i>	10001120	00000	10011	10021	10011	01

Table 2--continued.

SPECIES	MAXIMUM # LENTICLES PER POSITION						
	T1	T2-3	A1-2	A3-6	A7-9	A10	
	12345678	12345	12345	12345	12345	12	
<i>N. rubescens</i>	10001111	12010	10021	10022	10021	01	
<i>S. ceos</i>	10001110	00100	10111	10111	10111	11	
<i>S. mazans</i>	10001112	02101	00111	10111	00121	11	
<i>S. hayhurstii</i>	10001113	02100	00121	10111	10121	11	
<i>C. canescens</i>	10001110	11010	10121	10121	10121	11	
<i>X. trixus</i>	10001110	01110	10021	10021	10021	11	
<i>S. pulverulenta</i>	10002120	11000	10122	10110	10120	01	
<i>S. zampa</i>	10001120	11010	10021	10120	10120	10	
<i>A. thraso</i>	00001110	10000	10021	10111	10111	11	
<i>T. ruptifasciatus</i>	000001120	01110	10122	10121	10121	11	
<i>G. gesta</i>	10001120	12100	10112	10111	10111	11	
<i>E. brunneus</i>	10001100	11010	10012	10021	10022	01	
<i>E. icelus</i>	10001110	12010	10122	10121	10121	11	
<i>E. brizo</i>	10001110	12010	10123	10121	10111	11	
<i>E. juvenalis</i>	10001010	12110	10122	10121	10111	11	
<i>E. propertius</i>	10001110	12010	10122	10120	10110	11	
<i>E. horatius</i>	10001110	11010	10122	10121	10110	01	
<i>E. tristis</i>	10001110	12110	10122	10121	10111	01	
<i>E. martialis</i>	10001010	02100	10122	10121	10111	10	
<i>E. pacuvius</i>	10001010	12100	10122	10121	10111	11	
<i>E. zarucco</i>	00001110	12110	10122	10111	10111	11	
<i>E. funeralis</i>	10001110	02100	10122	10121	10111	11	
<i>E. baptisiae</i>	10001110	12100	10122	10111	10111	11	
<i>E. persius</i>	10001110	12100	10122	10121	10121	11	
<i>E. afranius</i>	10001110	12100	10122	10111	10111	12	
<i>P. centaureae</i>	10001120	12110	10021	10121	10121	11	
<i>P. ruralis</i>	10001110	11000	10121	10011	10111	11	
<i>P. scriptura</i>	10000110	11010	10111	10121	10121	11	
<i>P. communis</i>	10001110	11110	10111	10111	10111	11	
<i>P. albescens</i>	10001110	12010	10111	10111	10111	11	
<i>P. oileus</i>	10001110	02010	10111	10111	10111	11	
<i>H. ericetorum</i>	10001110	02010	10111	10111	10111	11	
<i>H. lavianus</i>	10001110	00010	10021	10021	10121	11	
<i>H. macaira</i>	10001110	00000	00111	10111	10111	11	
<i>H. arsalte</i>	10001110	12010	10111	10111	10111	11	
<i>C. nessus</i>	10001120	12010	00111	10111	10111	11	
<i>C. limpia</i>	10001120	12110	10111	10111	10111	11	
<i>P. catullus</i>	10001111	01100	10111	10111	10111	10	
<i>P. alpheus</i>	00001110	01000	00110	10111	10100	11	
HETEROPTERINAE:							
<i>P. pirus</i>	00110110	03100	00112	00117	00121	10	

Table 2--continued.

SPECIES	MAXIMUM # LENTICLES PER POSITION					
	T1	T2-3	A1-2	A3-6	A7-9	A10
	12345678	12345	12345	12345	12345	12
HESPERIINAE:						
<i>S. malitiosa</i>	00100010	02000	01112	01118	00112	11
<i>V. perigenes</i>	00100000	10110	10011	1001*	10111	01
<i>N. lherminier</i>	00000010	02100	01111	11116	11111	10
<i>N. julia</i>	00000010	02100	00101	00101	00112	10
<i>N. neamatyla</i>	00000010	02100	01121	01116	00111	10
<i>C. tripunctus</i>	00100110	03100	01112	01117	01111	01
<i>L. accius</i>	00100110	03010	01112	01119	01111	01
<i>L. liris</i>	00101110	03010	01112	01118	01111	01
<i>P. philetetes</i>	000000010	02010	01112	01113	01112	11
<i>A. numitor</i>	00101020	12010	01121	10123	11111	17
<i>A. arene</i>	000001120	02000	01111	01111	01111	14
<i>C. aurantiaca</i>	000000000	01000	00102	00104	00110	01
<i>C. minimus</i>	00101020	01000	00011	00103	00111	11
<i>T. lineola</i>	00101020	01000	00111	01116	01111	01
<i>H. phyleus</i>	00101120	12010	01121	01113	01111	10
<i>Y. carus</i>	00101120	02000	01111	01114	01111	10
<i>P. eunus</i>	000001010	11010	10011	10013	10011	01
<i>H. uncas</i>	00101010	11010	10011	10018	10011	12
<i>H. juba</i>	10120010	02010	01111	11116	10111	11
<i>H. comma</i>	10110120	02100	01111	01119	00111	11
<i>H. woodgatei</i>	10121110	10010	10011	10015	10011	11
<i>H. leonardus</i>	00101120	02100	01111	01116	01111	11
<i>H. pahaska</i>	00101120	12010	11111	11116	11111	11
<i>H. viridis</i>	00100020	11010	10011	10015	10111	11
<i>H. attalus</i>	00101010	11010	10011	10017	10111	11
<i>H. meskei</i>	00100010	02010	01111	01113	01111	11
<i>P. coras</i>	10101110	12010	10111	11118	11111	11
<i>P. sabuleti</i>	00101010	01010	11111	10123	11021	11
<i>P. mardon</i>	00101010	13010	11111	11113	11111	01
<i>P. draco</i>	10110120	02000	10011	1111*	01011	11
<i>P. baracoa</i>	00000120	03000	01111	01115	01111	10
<i>P. themistocles</i>	10121120	03100	01111	01115	01111	10
<i>P. origenes</i>	10140020	02100	01111	11117	01111	10
<i>P. mystic</i>	10120020	03000	01111	01110	01111	10
<i>P. sonora</i>	10121020	12110	01011	11110	01111	10
<i>P. vibex</i>	10110120	02100	01111	01114	11111	10
<i>W. otho</i>	10101110	13010	11111	11116	11111	11
<i>W. egeremet</i>	00000120	02000	01111	01117	01111	10
<i>P. verna</i>	11111010	11010	10011	10018	10111	11
<i>A. campestris</i>	11121120	02000	01111	01116	01111	10
<i>A. arogos</i>	00001110	12100	11112	11117	11112	00
<i>A. delaware</i>	10111120	02000	00112	00113	10111	01
<i>P. byssus</i>	00101120	02110	01112	0111*	01112	10

Table 2--continued.

SPECIES	MAXIMUM # LENTICLES PER POSITION									
	T1	T2-3	A1-2	A3-6	A7-9	A10	12345678	12345	12345	12
<i>O. sylvanoides</i>	10150020	03100	01122	01117	01111	11				
<i>O. agricola</i>	10130020	02100	01111	01119	01111	11				
<i>O. yuma</i>	10140120	02000	01111	01110	01111	11				
<i>P. hobomok</i>	11141110	11010	10001	1001*	10011	11				
<i>P. zabulon</i>	10130000	03000	01111	01118	01111	11				
<i>P. taxiles</i>	10101220	11010	10021	10029	10021	11				
<i>P. aaroni</i>	00131110	11010	11011	1101*	11111	11				
<i>P. yehl</i>	12141110	12010	11111	1111*	11111	11				
<i>P. viator</i>	031*1120	12110	11111	11118	10111	01				
<i>P. melane</i>	10141020	02110	01111	01117	01111	11				
<i>C. haitensis</i>	10110120	01100	11111	11116	01111	01				
<i>E. alabamae</i>	000101130	02100	01011	01119	01111	11				
<i>E. arpa</i>	000100030	12110	11112	1111*	11111	11				
<i>E. pilatka</i>	000101130	12110	11111	11118	11011	11				
<i>E. dukesi</i>	000101030	12110	11111	11117	11111	01				
<i>E. bimacula</i>	000101130	02100	01112	01115	01111	11				
<i>E. ruricola</i>	000101130	02100	01112	01116	01111	11				
<i>A. capucinus</i>	10111010	11010	11123	11119	11232	01				
<i>A. hianna</i>	001000110	02100	01212	0111*	01112	01				
<i>A. loammi</i>	10130120	02100	01212	0111*	01112	01				
<i>A. aesculapias</i>	00111010	11000	10011	10010	10111	11				
<i>A. vialis</i>	10120110	03100	00112	00119	00112	10				
<i>A. celia</i>	001000110	02100	00122	00116	00111	10				
<i>L. eufala</i>	00100110	03000	01112	01115	01111	11				
<i>O. maculata</i>	000001110	12110	11112	11118	11111	11				
<i>C. ethlius</i>	00102020	05000	01112	01117	01112	01				
<i>P. panoquin</i>	000101000	11110	11111	1111*	10111	10				
<i>P. panoquinoides</i>	000101020	01010	01012	01114	01112	11				
<i>P. ocola</i>	000101020	01010	01111	01113	01111	11				
<i>P. sylvicola</i>	000101010	01110	01111	01115	01111	11				
<i>N. nyctelius</i>	11121020	02000	01111	01111	01111	11				

Table 3. Maximum number of lenticles observed per segment and position on *Megathyminae* larvae in the present study. Lenticle positions are labelled 1 for lenticles above the spiracle line, 2 for lenticles below the spiracle line, and 3 for ventral lenticles. Position 1 on abdominal segment 10 refers to lenticles on the lateral margin of the caudal proleg. An asterisk indicates 10 to 15 lenticles present.

SPECIES	MAXIMUM # LENTICLES PER POSITION					
	T1 123	T2-3 123	A1-2 123	A3-6 123	A7-9 123	A10 1
<i>A. valverdiensis</i>	300	*00	700	400	500	0
<i>A. stephensi</i>	200	800	400	400	301	0
<i>M. y. yuccae</i>	100	300	612	910	*02	0
<i>M. y. martini</i>	100	120	813	610	402	1
<i>M. y. reinthali</i>	000	200	515	800	802	0
<i>M. coloradensis</i> kendalli	000	200	503	700	802	0
<i>M. coloradensis</i> navajo	000	300	903	800	601	0
<i>M. cofaqui</i>	000	900	304	*00	*01	0
<i>M. u. ursus</i>	010	300	602	500	402	0
<i>M. u. violae</i>	000	210	302	900	702	0

thickenings, internally derived colors, or may not have been included in the description. Megathymines lack bright cuticular pigments, but may be cream-colored, bluish or greenish from chlorophyll and other pigments inside the body. Red colors seem to occur only in pyrgines and pyrrhopygines. The ventral prothorax of some pyrgines such as *Epargyreus clarus* is often bright red or reddish-brown in color. Yellow or orange pigments occur in many pyrgines and some hesperiines. White or cream-colored cuticular pigments are more broadly distributed in hesperiines. The only skipper larva that I have seen with extensive black pigment is *Codatractus hyster*.

Colors on the body of hesperiid larvae are most commonly distributed as stripes (Figure 9). Usually the stripes occur longitudinally, but Pyrrhopygines and some pyrgines have transverse stripes of yellow or white. Transverse stripes seem to occur on unpalatable lepidopteran larvae such as the sphingid, *Pseudosphinx tetrio*.

Longitudinal stripes typically occur only in certain locations such as a heart line, a subdorsal line, or a lateral line. The heart line is always present because the cuticle above the heart tends to be less pigmented than elsewhere on the body. The subdorsal line is usually a narrow stripe that may sometimes be interrupted to form a line of spots. The lateral stripe is less frequently present, but may form a broad band across the side of the

body. In some species the body is covered with tiny white or yellowish spots and the stripes are formed by the absence of these colors. In other cases the stripes are outlined with white or yellow, forming double bands (Figure 9B). Some lines or spots on pyrgines such as *Epargyreus* and *Urbanus* may also be present due to patches of black microspines (Figure 9D). The texture of the cuticle of most hesperiids is rough, particular on pyrgines.

The larval head consists of several sclerites. The head capsule is divided into two major sections (epicrania) by the frontal and adfrontal sclerites and the epicranial suture along the vertex. The front varies in shape from nearly an equilateral to an isosceles triangle, usually the latter. Below the frontal sclerite lies the clypeus and next the labrum. The labrum of hesperiids is small with a shallow mesal notch. Along the posterior margin of the head is the postocciput. This sclerite is normally a very narrow band in most Lepidoptera, but is frequently very wide or moderately wide in the Hesperiidae. In pyrgines, the postocciput is usually very wide to moderately wide, lending in part to the "narrow neck" often referred to by authors (Figure 10). The postocciput is narrow to occasionally moderately wide in hesperiines (*Orthos lycortas*, *Paratrytone melane*) as well. Megathymines have a narrow postocciput coupled with a large prothorax, creating a "wide neck"

(Figure 10D). The transverse width of the head capsule of U. S. skippers varies from 1.5 to 7.2mm.

The head capsule of hesperiids usually has a rough texture due to polygonal patterns of sculpturing (Figure 11). The sculpturing may form small pebbly knobs in pyrgines. These knobs are sometimes enlarged and modified into small spines at the apex of the epicranium (Figure 12). The ridges of the polygonal sculpturing may also be greatly widened, except for the center, resulting in a pattern of pits in hesperiines. Pyrrhopygines have a unique and characteristic series of low vertical ridges on the face (Figure 11D). The head capsule of *Copaeodes aurantiacus*, a hesperiine, has two forward pointing processes, but its close relative, *Copaeodes minimus*, does not.

Klots (1966) named and described paraclypeal hooks on the larva of *Amblyscirtes samoset*. The hooks are downward projecting spines, one on each side of the clypeus (Figure 11E). Their function remains unknown. I have seen this structure only in *Amblyscirtes* species (Hesperiinae) and *Piruna pirus* (Heteropterinae).

Hesperiids have six simple eyes or stemmata on the lower part of each epicranium (Figure 13). The relative size and spacing of the stemmata often varies between species. Stemma one through four lie in an arc and are usually equally spaced. Stemma five and six are usually farther apart.

The labial-submental complex occupies a relatively large portion of the ventral head of most lepidopteran larvae. In hesperiids, however, the labial-submental complex is small relative to the size of the head, except for megathymines, which have large labial-submental complexes.

The mandibles of hesperiines and heteropterines are articulated somewhat differently from other skippers.

Hesperiine mandibles are longer in the dimension between the labrum and labium than in the dimension between the antennae (Figure 14). The articulation supporting this longer mandible is also elongate. Pyrgine mandibles are subequal in these dimensions. Most hesperiids lack teeth or at most have shallow lobes on the mandibles. Well developed-teeth are present in some pyrgines and megathymines.

Hesperiid larvae have a pair of short antennae that arise from a membranous area adjacent to the mandibles. The antenna consists of three segments, the distal segment being very small. A long sensory seta occurs on the tip of the second segment.

Color patterns on the heads of skipper larvae are often striking. The pattern may be light spots or stripes on a dark ground, dark spots or stripes on a light ground, or variegated. Pyrgines frequently have spots on the face, and sometimes a lateral line. Hesperiines often have stripes on the face. The stripes usually occur in specific areas. The

medial stripe proceeds from the vertex along the epicranial suture, then branches and proceeds partway along the adfrontal sclerites. The epicranial line proceeds from near the apex to the lower part of the face or may be broadly joined with the medial stripe along the adfrontals. The lateral stripe proceeds from the vertex, along the lateral margin of the head to the stemmatal area. Two skipper groups have uniformly colored heads, megathymines which are mostly concealed in stems, leaves, or roots, and pyrrhopygines, which have dense long setae on the head. In addition, pyrgines sometimes have two brightly colored (yellow, orange, or red) false eye patches on the lower face between the stemmata and the mandibles. Eye patches also occur in hesperiines, but are smaller and less colorful.

The dorsum of the prothorax is often sclerotized and darkened in larval hesperiids. The prothoracic shield may be relatively wide, covering much of the dorsum, reduced to a narrow band between the major annuli, or indistinct. The shield usually extends laterally onto a small hump. The hump is often darkened, but separated from the dorsal part of the shield in third and fourth instar larvae. The hump also frequently bears a lenticle and a pinaculum, the seta of which is longer and more slender than the surrounding setae. Another pinaculum is present in a more dorsal position on the mesothorax. A small cluster of lenticles usually accompanies the mesothoracic pinaculum as well. On

the ventral side of the prothorax lies the opening to a specialized gland, thought to produce defensive chemicals (Eisner et al. 1972). Most hesperiids have the ventral prothoracic gland, but I cannot find the opening in Megathyminae. The prothoracic spiracle often varies in shape between hesperiid species. Typically the spiracle is oval, but the anterior rim is frequently elongate in some species.

The color of the thoracic legs is often useful in distinguishing species. In most skippers the legs are all pale or all dark. Others have only the first or second legs darkened. The thoracic leg length of hesperiines and pyrgines is usually moderate, but some species have relatively shorter or longer legs. Leg length seems to be partly correlated to larval ecology. Hesperiines that live near the ground, such as *Hesperia* species, often have long thoracic legs, whereas epiphytic species, such as *Lerodea eufala*, have very short legs. A few pyrgines have a row or small clusters of lenticles anterior to the legs.

Abdominal segments one and two of the larvae lack legs and are transitional to the thoracic segments. Segments three through six are similar and bear a pair of prolegs. Segments seven and eight lack legs and are transitional to the terminalia. Segment nine is reduced to a small annulus between segment eight and ten. Segment ten bears the anal prolegs and is modified for disposal of the frass.

The prolegs of segments three through six bear small hooks (crochets) in a circle, a near circle, a mesal penellipse, or transverse bands. The crochets are sometimes uniordinal or biordinal, but most often are in more or less three ranks (triordinal). The crochet band is always uniordinal near the lateral margin and quickly becomes biordinal and triordinal toward the meson. In some pyrgine genera such as *Achalarus*, *Thorybes*, and *Cabares*, the posterior or mesal crochets are nearly twice as large as the anterior series of each proleg. Only one species that I have examined, *Polygonus leo*, has ventral lenticles in small clusters anterior of the prolegs.

The last stage larvae of some hesperiines and megathymines develop wax glands prior to pupation (Dethier 1942c). The wax produced by the glands is used to coat the inside of the cocoon. The gland pattern on the ventral surface of the larva varies considerably (Figure 15). The U. S. species with wax glands usually develop longitudinal or transverse patches on the ventral side of abdominal segments seven and eight (Figure 15A and B). The wax glands of *Perichares philetas* form a transverse patch on the ventral side of abdominal segment one. *Synapte malitiosa* has transverse patches on abdominal segments three through six. In *Choranthus haitensis* and *Asbolis capucinus*, these patches are reduced to small spots posterior of the prolegs.

Abdominal segment ten usually bears an anal comb. The anal comb is a fan-shaped, sclerotized structure located caudad and dorsal to the anus (Figure 16). During the act of defecation, the anal comb functions to propel the fecal pellet away from the caterpillar. This is accomplished with some force and the pellets may be launched several feet away. The base of the anal comb is wider in pyrgines than hesperiines. The anal comb is degenerate, but usually present, in megathymines, consisting of up to about dozen spines.

The suranal plate of most U. S. hesperiids is rounded, but the plate is pointed in a few hesperiines (*Copaeodes* spp.). Other hesperiines (*Atrytone delaware*, *Polites* spp.) have dark lines or markings on the suranal plate. The broad, bill-like plate of *Asbolis capucinus* is edged with black and the terminal spiracles are black, forming a false face.

Pupae

The pupae of U. S. hesperiids range in length from 10.5 to 52mm and in width from 2.1 to 10.3mm. The length of the abdomen varies between groups of hesperiids, being very short in species such as *Epargyreus clarus* and very long in *Megathymus* spp. The difference is due mostly to a change in the size of abdominal segments five through ten, as these lie beyond the wings. Most skipper pupae are brown or cream-colored, but some are green. Like their larvae,

hesperiid pupae have a head, three thoracic segments, and ten abdominal segments. The antennae, legs, and wings are visible, but are glued to the body. The prothorax and abdominal segments two through eight bear spiracles. The thoracic spiracle is usually guarded by a cluster of microspines. In most pyrgines, the spiracle guard is on a small cuticular rise, giving the pupa a false face appearance when viewed from the front. The distal tip of the abdomen is modified into the cremaster, a structure used to anchor the pupa to the substrate. The cremaster shows considerable variation between species and higher groups.

The setae on hesperiid pupae are usually short and simple. A few pyrgines, however, have some bifurcate setae. A neotropical species, *Arteurotia tractipennis*, has long plumose setae on the head. Species with long larval setae generally have long setae on the pupae as well. Many hesperiines have very short or inconspicuous setae. Lenticles occur only on hesperiine pupae. The prothorax, dorsal abdomen, and ventral proleg scars of hesperiine pupae typically have lenticles (Figure 17).

The head of most hesperiid pupae is rounded; however, some modifications do occur (Figure 18). A few pyrgines and many hesperiines have pointed processes on the cap. The point may be straight and relatively thick at the base (*Lerema accius*), slender and upturned (*Calpodes ethlius*), or T-shaped at the tip (*Justinia phaetusa*, a neotropical

species). Instead of being pointed, the cap may be bulbous as in *Atrytone delaware* and *Poanes viator*. The head also bears a pair of sclerites (pilifers) which represent the mandible remnants. Pyrrhopygines, pyrgines, and megathymines always have the pilifers separated, whereas, most hesperiines have the pilifers touching.

The position of the antennal tip relative to the tip of the middle leg on the pupae of hesperiids shows a good deal of variation. The antennae extend to the tip of the middle leg in Pyrrhopygines, and many pyrgines. In other pyrgines, most hesperiines, and megathymines the distal tip of the antenna lies far cephalad of the tip of the middle leg. Likewise, the proboscis usually reaches to the wing tips in pyrrhopygines and pyrgines, extends far beyond the wing tips in hesperiines, and lies far cephalad of the wing tips in megathymines. The distal part of the proboscis case is not glued to the body if this structure extends beyond the wings.

Figure 3. SEM micrographs of the egg of *Urbanus proteus* (A), *Telemiades epiculus* (B), *Thorybes pylades* (C), *Polites vibex* (D), *Hylephila phyleus* (E), *Atrytone delaware* (F), *Euphyes ruricola* (G), *Copaeodes minimus* (H), and *Megathyymus cofaqui* (I).

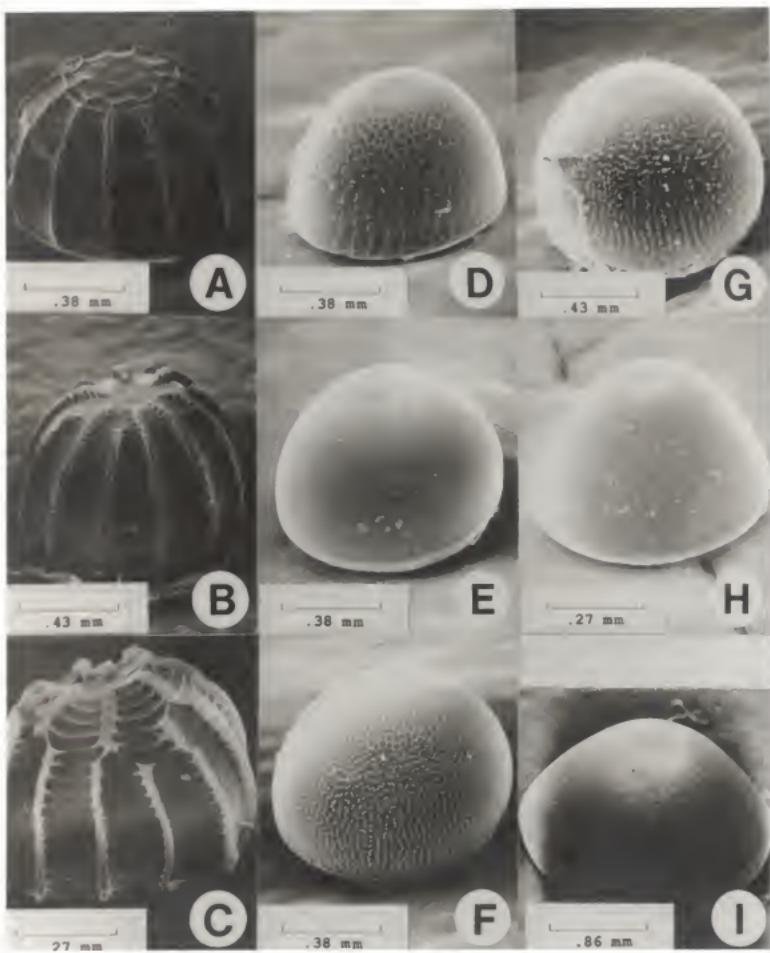


Figure 4. SEM micrographs of the micropylar region of the egg of *Urbanus proteus* (A), *Telemiades epicalus* (B), *Erynnis horatius* (C), *Hesperia attalus* (D), *Polites baracoa* (E), *Atrytone delaware* (F), *Problema byssus* (G), *Poanes yehl* (H), and *Euphyes ruricola* (I).

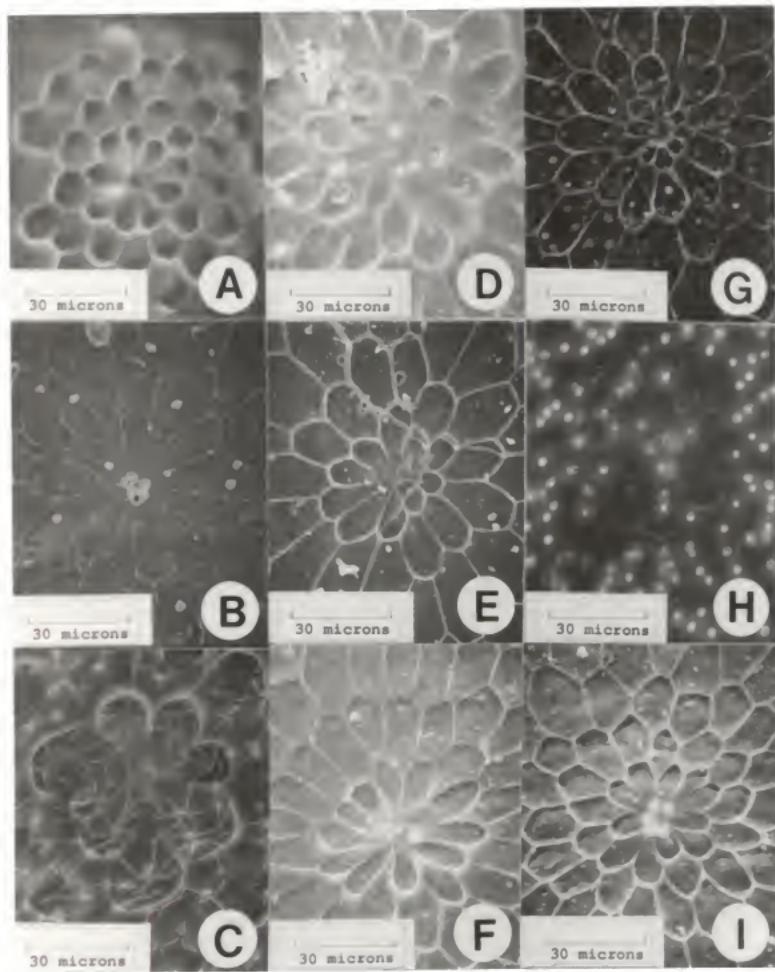
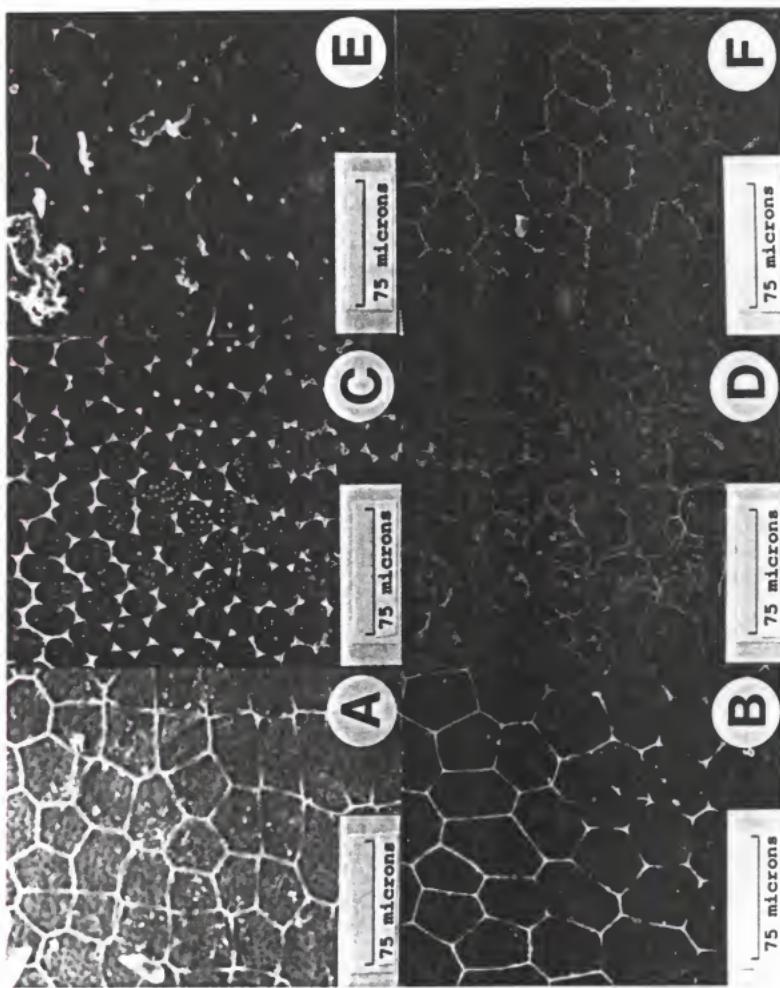


Figure 5. SEM micrographs of the sculpturing on the sides of the egg of *Atalopedes campestris* (A), *Polites vibex* (B), *Atrytone delaware* (C), *Problema byssus* (D), *Euphyes ruricola* (E), and *Megathymus cofaqui* (F).



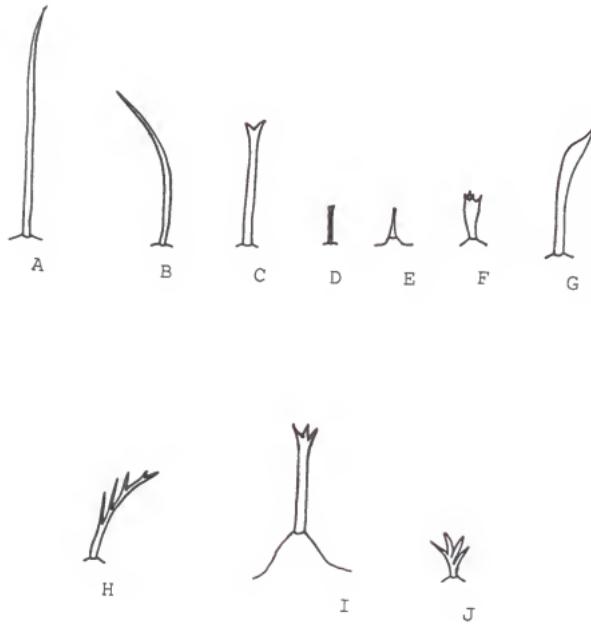


Figure 6. Comparison of setae on the body of *Pholisoracatullus* (A), the head of *Achalarus casica* (B), the body of *P. catullus* (C), the body of *Urbanus proteus* (D), the body of *Ancyloxypha numitor* (E), the body of *Hesperia juba* (F), the head of *Xenophanes trixus* (G), the body of *Pyrgus communis* (H), the body of *Thorybes bathyllus* (I), and the body of *Cogia outis* (J).

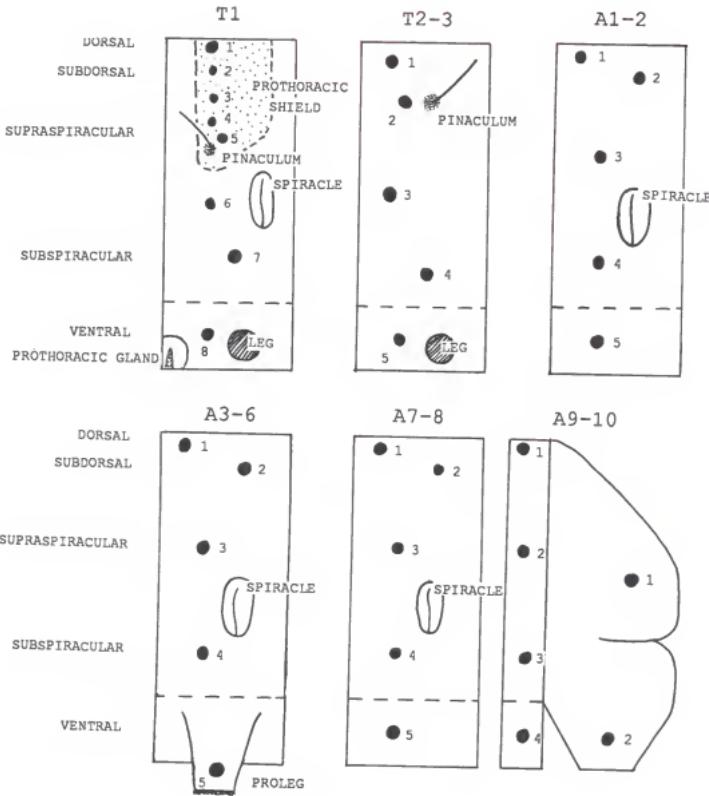


Figure 7. Generalized map of the lenticles and other features of the last instar hesperiid larva.

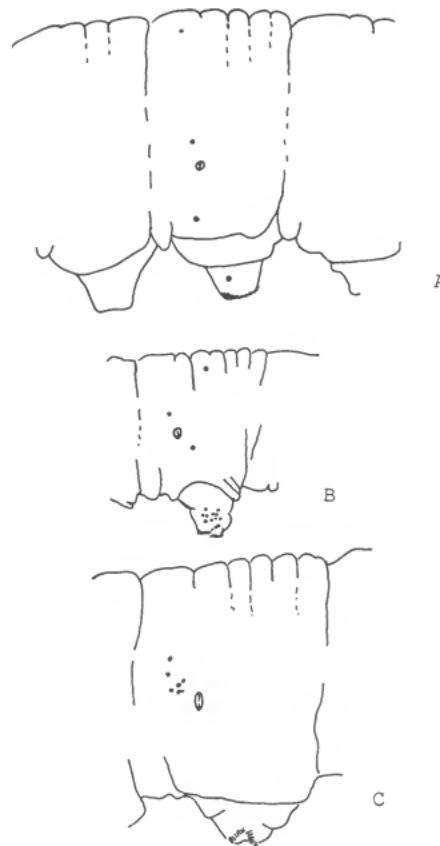


Figure 8. Lenticles on the fourth abdominal segment of *Pholisorca catullus* (A), *Problema byssus* (B), and *Megathyphus yuccae* (C).

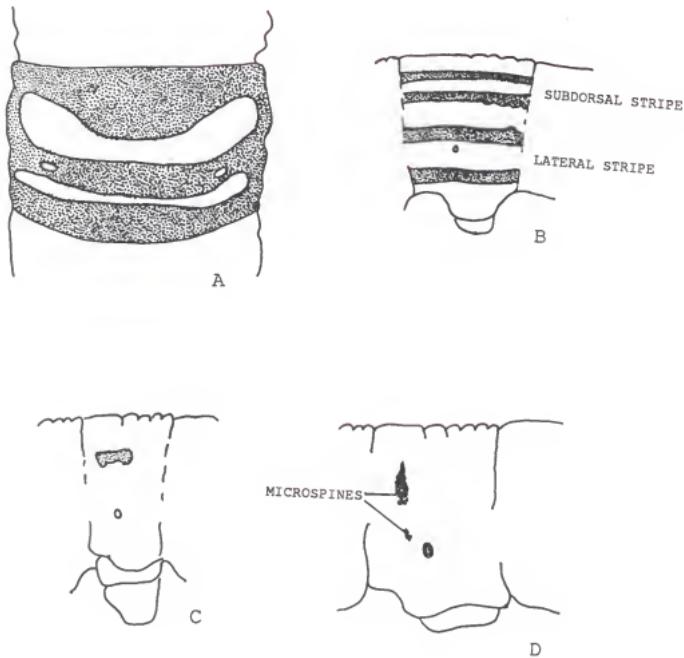


Figure 9. Color patterns on the fourth abdominal segment of some U. S. hesperiids: dorsal view of transverse stripes on *Astraptes fulgerator* (A), lateral view of subdorsal and lateral stripes bounded by white (shaded portion) on *Copaeodes aurantiacus* (B), lateral view of the interrupted subdorsal stripe of *Codatractus arizonensis* (C), and lateral view of patches of black microspines on *Epargyreus clarus* (D).

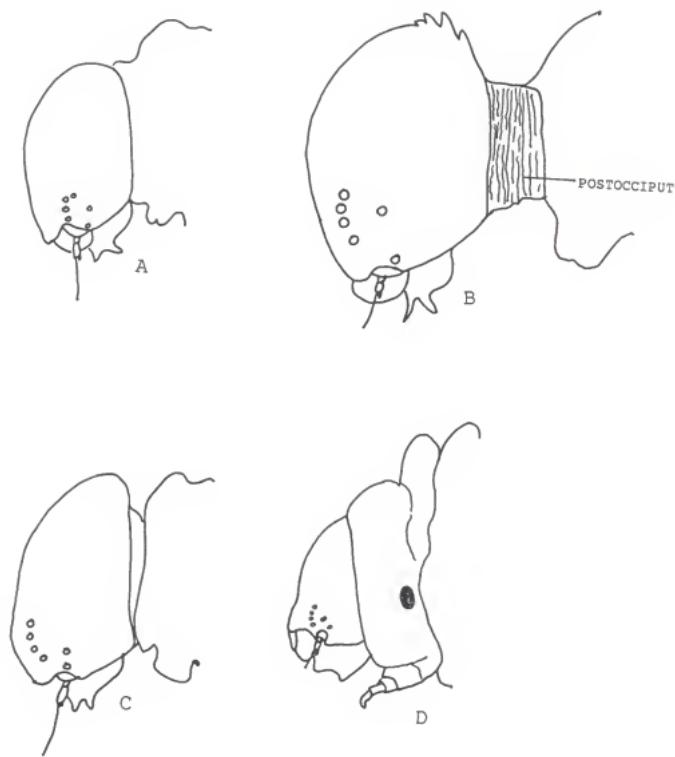


Figure 10. Relative size of the "neck" of last instar larvae of *Pyrrhopgye araxes* (A), *Urbanus teleus* (B), *Problema byssus* (C), and *Megathymus yuccae* (D).

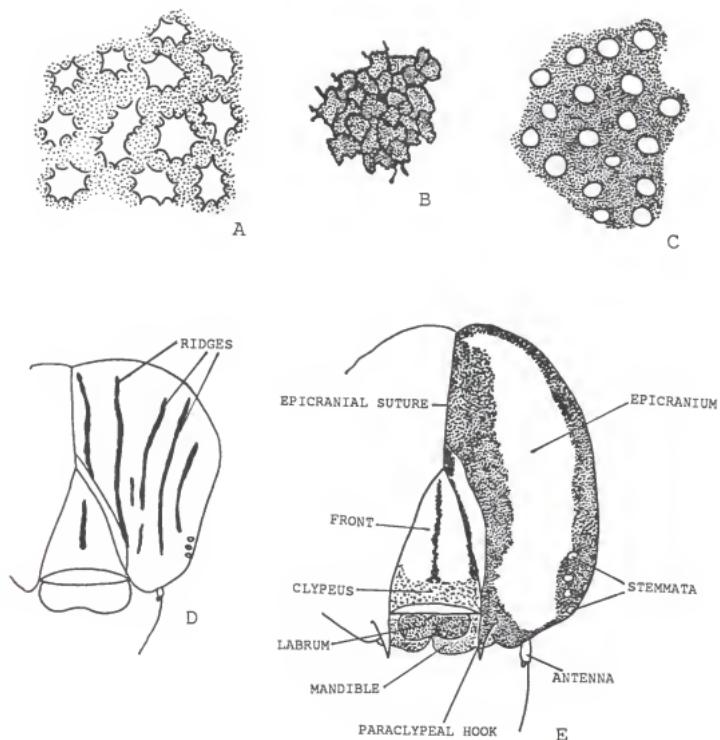


Figure 11. Features of the larval head of hesperiids: pebbly sculpturing of *Polythrix procera* (A), rough sculpturing of *Staphylus mazans* (B), pitted sculpturing of *Hesperia pahaska* (C), ridges on the head of *Pyrrhopyge chalybea* (D), and general structures on *Amblyscirtes vialis* (E).

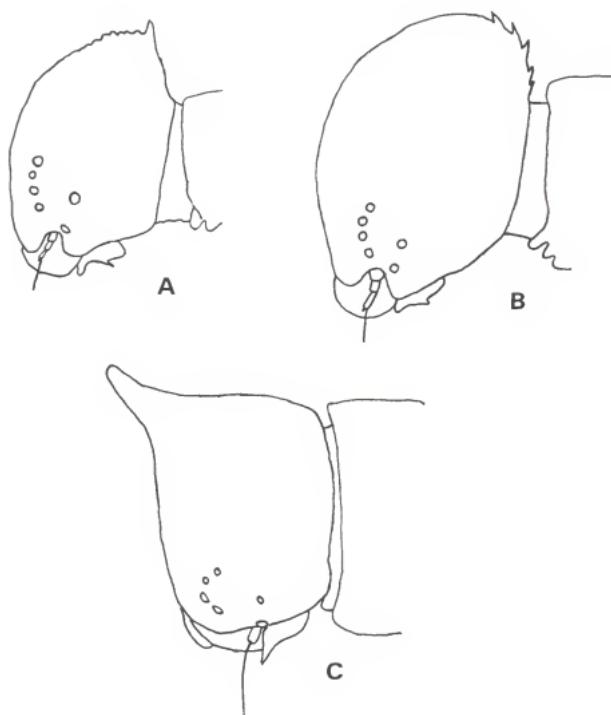


Figure 12. Processes on the head of *Urbanus procne* (A), *Achalarus lyciades* (B), and *Copaeodes aurantiacus* (C).

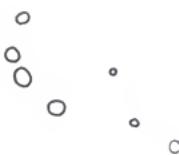
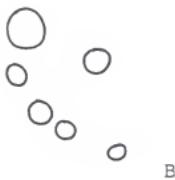
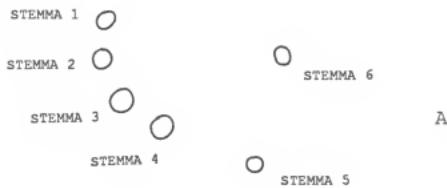


Figure 13. Comparison of the stemmata of *Pyrrhopygæ araxes* (A), *Achlyodes thraso* (B), and *Euphyes pilatka* (C).

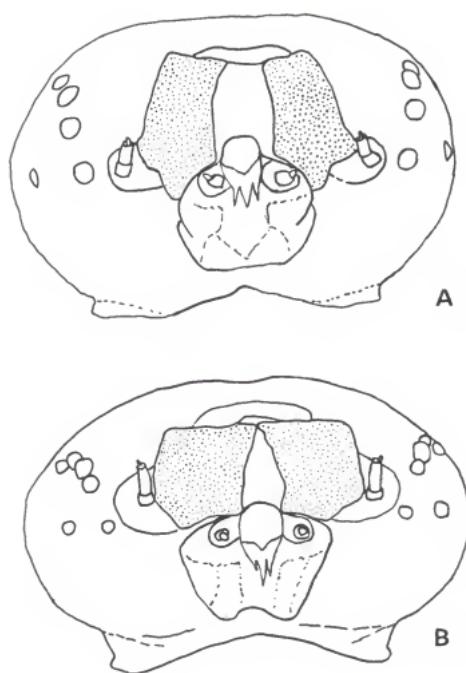


Figure 14. Ventral view of the hesperiine-type mandibles of *Atalopedes campestris* (A) and the pyrgine-type mandibles of *Erynnis horatius* (B).

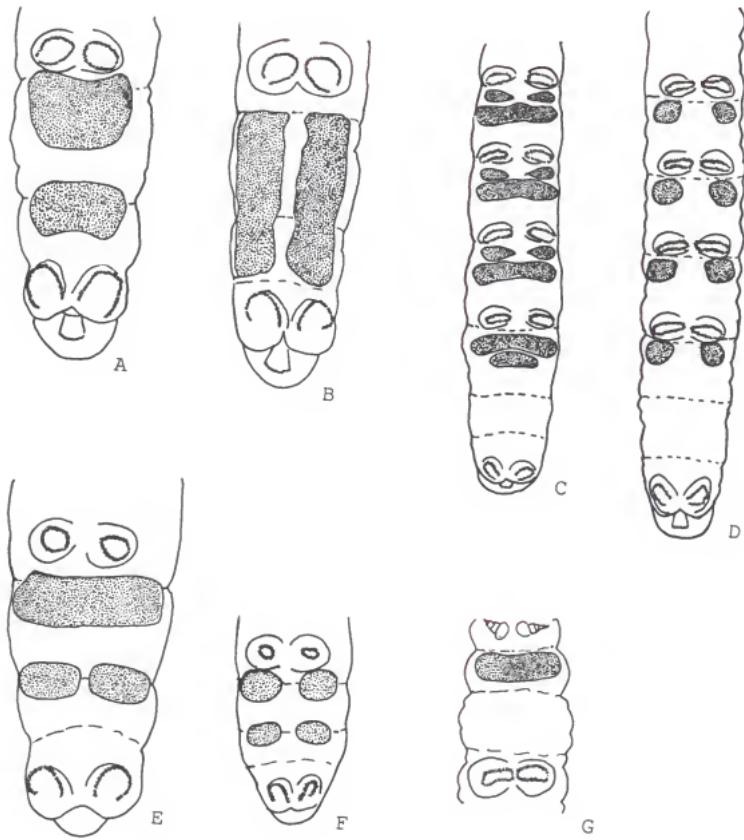


Figure 15. Wax gland distribution on *Problema byssus* (A), *Lerema accius* (B), *Synapte malitiosa* (C), *Asbolis capucinus* (D), *Hesperia juba* (E), *Ochlodes agricola* (F), and *Perichares philetetes* (G).

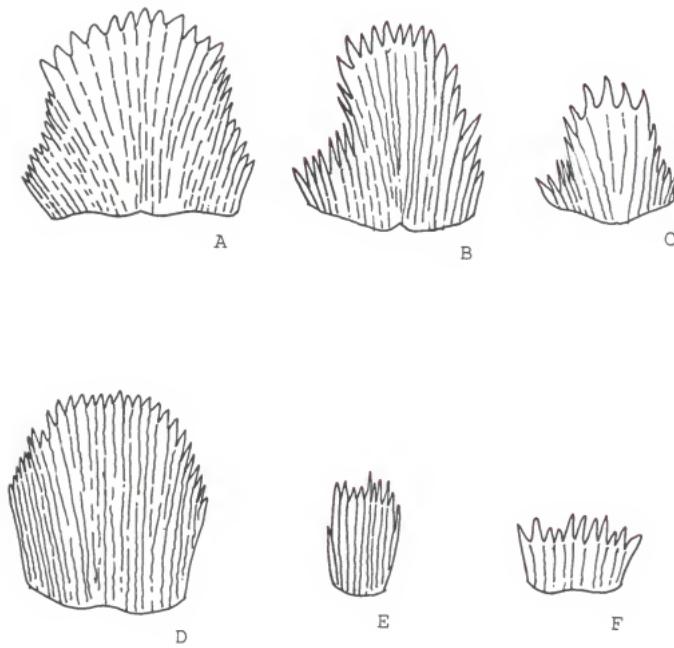


Figure 16. Comparison of the anal comb of *Urbanus proteus* (A), *Thorybes mexicanus* (B), *Pyrgus scriptura* (C), *Polites themistocles* (D), *Pseudocopaeodes eunus* (E), and *Megathymus yuccae* (F).

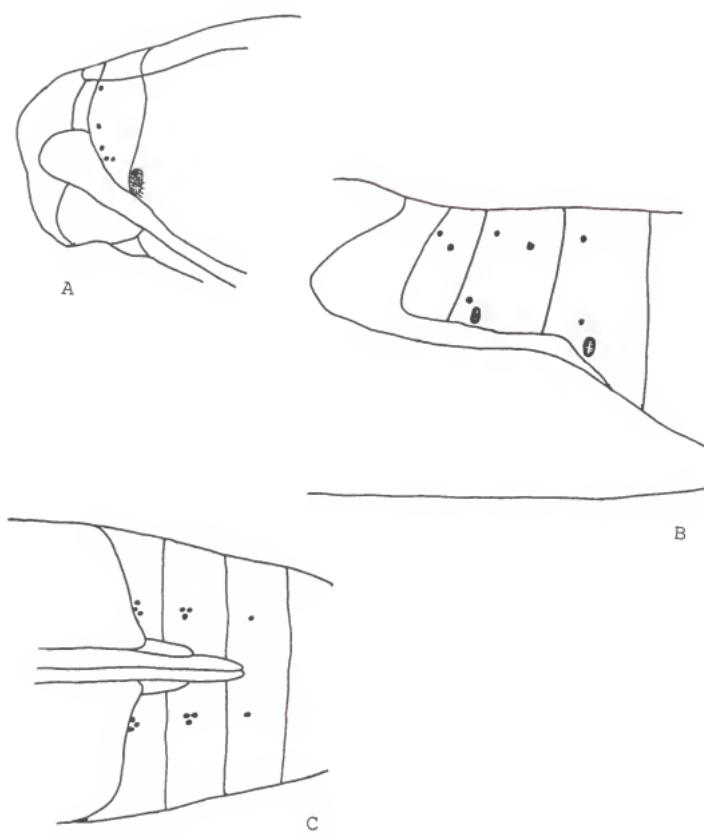


Figure 17. Lenticle distribution on the prothorax of the pupa of *Pseudocopaeodes eunus* (A), on the dorsal abdomen of *Hylephila phyleus* (B), and on the proleg scars of *Yvretta carus* (C).

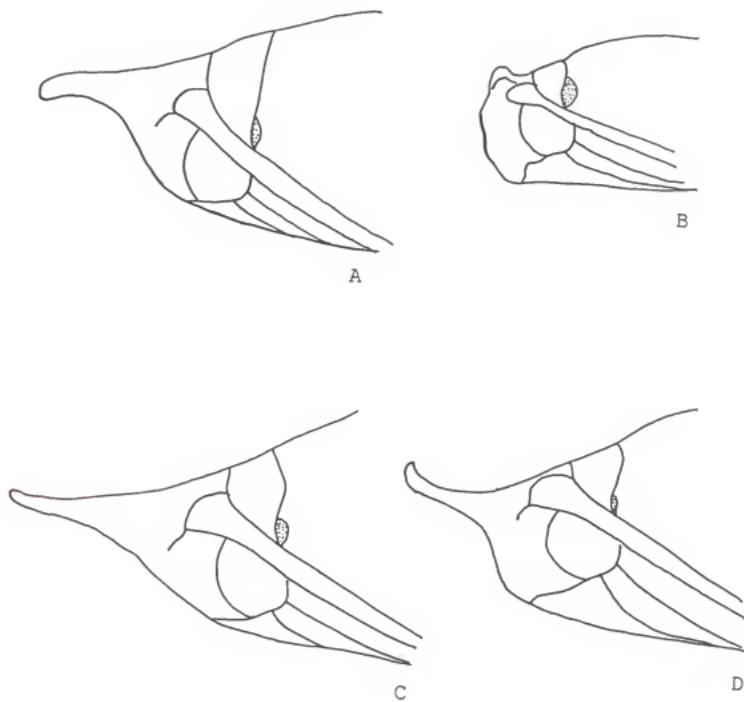


Figure 18. Lateral view of the pupal cap of *Perichares philetetes* (A), *Atrytone delaware* (B), *Panoquina panoquin* (C), and *Calpodes ethlius* (D).

CHAPTER 5

DIAGNOSES AND HOST PLANTS FOR THE UNITED STATES SKIPPERS

In the following chapter, I present a diagnosis of the immature stages for each subfamily and for each species of Hesperiidae recorded for the United States. If personal observations were lacking and a thorough search of the literature turned up no reference to previous description, that negative information is listed under the species name so that future workers can concentrate their efforts on those taxa to complete our picture of the North American skipper fauna.

Subfamily Pyrrhopyginae

Diagnosis. EGG: no specimens available, undescribed in literature. LAST INSTAR LARVA: BODY: length to ca. 50mm, A4 transverse width to ca. 10mm; brightly colored with red, yellow, or white, frequently with transverse stripes; setae simple, long; spiracles tan, T1 and A8 spiracles largest. HEAD: uniformly dark; transverse width ca. 7mm; sculpturing rough, with several low ridges extending from the upper to lower face; mandibles without teeth, pyrgine type articulation; labial-submental complex relatively small; setae simple, long; stemmata subequal; postocciput narrow. THORAX: prothorax slightly larger than head; legs tan;

shield narrow; ventral prothoracic gland present. ABDOMEN: A4 proleg with ca. 140 crochets, irregularly triordinal, arranged in a circle, posterior prolegs always with a mesal penellipse; suranal plate rounded, unmarked; anal comb well developed; wax glands absent. PUPA: robust; thoracic spiracle guard distinct; setae relatively long; pilifers separated; head rounded; antennal tip extending to slightly beyond tip of middle leg; proboscis extending to the wing tips; abdomen short; cremaster blunt with numerous hooked setae in a cluster at the tip.

1. *Pyrrhopyge araxes*

Diagnosis. LAST INSTAR LARVA: BODY: length 47mm, A4 transverse width 9.7mm; preserved specimen brownish red with narrow transverse yellow stripes on T1-A9; setae simple, to 6.4mm long on A4 dorsum; spiracles tan. HEAD: dark brown; transverse width 7.2mm; sculpturing rough, with ridges on face; mandibles without teeth; setae simple, to 5mm long at apex, a few ventral setae to 5.7mm; stemmata subequal (Figure 37A); postocciput narrow. THORAX: legs tan; shield narrow, a dark brown band between the annuli. ABDOMEN: prolegs each with about 140 crochets, irregularly triordinal, arranged in nearly a circle; suranal plate rounded, unmarked (Figure 45A).

Other Descriptions. Dyar 1906 (larva), Comstock 1956b (larva, pupa).

Host Plants. FAGACEAE: *Quercus arizonica* (Burns 1964a), *Quercus emoryi* (Bailowitz and Brock 1991, in lab), *Quercus oblongifolia* (Bailowitz and Brock 1991, in lab). MYRTACEAE: *Psidium guajava* (Beutelspacher 1980) [questionable].

Specimens Examined. LARVAE: ARIZONA: Lot 002, 1 larva (instar 5) (NM); Lot 552, 1 larva (instar 4) (NM).

Subfamily Pyrginae

Diagnosis. EGG: usually with 10 to 30 vertical ribs, occasionally with polygonal sculpturing or with 30 to 50 vertical rows of short spines, height 0.5-1.3mm, diameter 0.6-1.8mm; white, yellow, orange, or green, occasionally red, gray, or brown. LAST INSTAR LARVA: BODY: length 8-49mm, A4 transverse width 1.8-9.8mm; often with red, yellow, or orange markings, rarely with transverse stripes; some setae often modified with blunt or expanded tips, < 0.1-1.6mm long; spiracles pale to dark, T1 and A8 spiracles largest. HEAD: pale, dark, or patterned, sometimes with colorful eye patches; transverse width 2-6.4mm; sculpturing rough to pebbly, occasionally with small spines or knobs at apex; mandibles with or without teeth, pyrgine type articulation; labial-submental complex relatively small; setae simple, branching, or feathery, < 0.1-2mm long; stemmata usually subequal; postocciput wide or moderately wide. THORAX: prothorax about the same size as head or smaller; legs pale to black; shield narrow to broad; ventral

prothoracic gland present. ABDOMEN: A4 proleg with 30 to 230 crochets, uniordinal, biordinal, or irregularly triordinal, arranged in a circle, a near circle, or a mesal penellipse, posterior prolegs always with a mesal penellipse; suranal plate rounded, unmarked; anal comb well developed; wax glands absent. PUPA: length 10.5-32mm, A3 transverse width 3.2-10.3mm; green or brown; thoracic spiracle guard distinct; setae < 0.1-1mm; pilifers separated; head usually rounded, occasionally with a short pointed process on cap; antennal tip may lie slightly caudad of tip of middle leg or far cephalad of middle leg tip; proboscis extending to the wing tips, occasionally slightly beyond; abdomen short or moderately long; cremaster blunt with numerous hooked setae in a cluster at the tip.

2. *Phocides pigmalion* (Cramer)

Diagnosis. LAST INSTAR LARVA: BODY: length 23-32mm, A4 transverse width 5.3-7.7mm; white; setae simple, to 0.2mm long on A4 dorsum; spiracles tan. HEAD: reddish brown, darker around the mouth, large yellow eye patches present; transverse width 5-5.3mm; sculpturing pebbly; mandibles without teeth; setae simple, to 0.2mm long at apex, a few ventral setae to 0.7mm; stemmata subequal (Figure 37B); postocciput wide. THORAX: legs tan; shield broad, tan. ABDOMEN: prolegs each with about 230 crochets, irregularly triordinal, arranged in a circle; suranal plate rounded, unmarked (Figure 45B). PUPA: Figures 58D, 61A and 78A,

length 25-32mm, A3 transverse width 7.5-9.8mm; greenish white; thoracic spiracle guard absent; setae simple, to 0.5mm long on head; head rounded, cap bulbous with a slight mesal indentation; antennae extend slightly caudad of tip of middle leg; proboscis extending to the wing tips; abdomen moderately long; cremaster to 2.5mm long, blunt with numerous hooked setae in a cluster at the tip (Figures 101A and 112A).

Other Descriptions. Dyar 1890 (egg, larva, pupa), Strohecker 1938 (larva, pupa), Minno and Emmel 1993 (larva, pupa).

Host Plants. RHIZOPHORACEAE: *Rhizophora mangle* (Dyar 1890).

Specimens Examined. LARVAE: FLORIDA: BROWARD CO.: Lot 364, 1 larva (instar 5) (MCM). DADE CO.: Lot 1272, 1 larva (instar 2) (DHH). MONROE CO.: Lot 365, 1 larva (instar 5) (MCM); Lot 728, 1 larva (instar 4) (MCM); Lot 729, 1 larva (instar 4) (MCM). PUPAE COLLIER CO.: Lot 363, 1 pupa (MCM); Lot 365, 2 pupae (MCM).

3. *Phocides palemon* (Cramer)

Diagnosis. EGG: height 1.6-1.8mm, width 1-1.3mm, 17-19 ribs, red. LAST INSTAR LARVA: BODY: length 21.5-33mm, A4 transverse width 5.8-9.1mm; preserved specimens pale; setae simple, to 0.3mm long on A4 dorsum; spiracles tan. HEAD: Figure 22A, pale reddish brown, darker around the mouth, large yellow eye patches present; transverse width 4.7-

5.5mm; sculpturing pebbly; mandibles without teeth; setae simple, to 0.2mm long at apex, a few ventral setae to 0.7mm; stemmata subequal (Figure 37C); postocciput wide. THORAX: legs tan; shield broad, tan. ABDOMEN: prolegs each with about 165 crochets, irregularly triordinal, arranged in a circle. PUPA: Figures 61B and 78B, length 24-26mm, A3 transverse width 8.3-10mm; preserved specimens pale; thoracic spiracle guard absent; setae simple, to 0.5mm long on head; head rounded, cap bulbous with a slight mesal indentation; antennae extend slightly caudad of tip of middle leg; proboscis extending to the wing tips; abdomen short; cremaster to 2.2mm long, blunt with numerous hooked setae in a cluster at the tip (Figures 101B and 112B).

Other Descriptions. Comstock and Vazquez 1960 (larva, pupa).

Host Plants. MYRTACEAE: *Eugenia uniflora* (Neck 1983), *Psidium cattleianum* (Neck 1978), *Psidium guajava* (Comstock and Vazquez 1960).

Specimens Examined. EGGS: TEXAS: CAMERON CO.: Lot 962, 12 eggs (ROK). LARVAE: MEXICO: GUERRERO: Lot 866, 7 larvae (instars 4, 5) (USNM). TEXAS: CAMERON CO.: Lot 777, 1 larva (instar 5) (USNM); Lot 883, 1 larva (instar 5) (USNM); Lot 962, 3 larvae (instar 5) (ROK). PUPAE: TEXAS: CAMERON CO.: Lot 962, 4 pupae (ROK).

4. *Phocides urania* (Westwood)

Nothing is known of the biology of this neotropical species.

5. *Proteides mercurius* (Fabricius)

This species rarely enters the U. S. from tropical America. Its biology is poorly known. No immature specimens were located for study.

Descriptions. Draudt 1924 (larva, pupa), Comstock and Vazquez 1960 (larva, pupa).

Host Plants. FABACEAE: *Cassia* species (Draudt 1924), *Derris elliptica* (Wolcott 1941), *Ecastophyllum* species (MacNeill 1975), *Muellera moniliformis* (Moss 1949), *Rhynchosia* species (MacNeill 1975), *Vigna* species (MacNeill 1975).

6. *Epargyreus zestos* (Geyer)

Diagnosis. LAST INSTAR LARVA: BODY: length 31-48mm, A4 transverse width 6.2-8.2mm; green with numerous narrow transverse yellow stripes, prothorax reddish ventrally, prolegs orange; some setae with expanded tips, to 0.1 mm long on A4 dorsum; spiracles dark brown. HEAD: black, large yellow eye patches present; transverse width 5.2-5.9mm; sculpturing pebbly; mandibles without teeth; setae simple, to 0.1mm long at apex, a few ventral setae to 0.7mm; stemmata subequal (Figure 37D); postocciput wide. THORAX: legs tan; shield broad, brown. ABDOMEN: prolegs each with about 180 crochets, irregularly triordinal, arranged in a

circle; suranal plate rounded, unmarked (Figure 45C). PUPA: Figures 61C and 79A, length 24.5-28mm, A3 transverse width 8.8mm; brown; thoracic spiracle guard distinct; posterior margin of prothorax crenulated; some setae with slightly expanded tips, to 0.1mm long on head; head rounded; antennae extend slightly caudad of tip of middle leg; proboscis extending to the wing tips; abdomen short; cremaster to 2mm long, blunt with numerous hooked setae in a cluster at the tip (Figures 101C and 112C).

Other Descriptions. Minno and Emmel 1993 (larva, pupa).

Host Plants. FABACEAE: *Galactia striata* (Scott 1986).

Specimens Examined. LARVAE: FLORIDA: MONROE CO.: Lot 137, 1 larva (instar 5) (MCM); Lot 138, 1 larva (instar 5) (MCM); Lot 139, 3 larvae (instars 3, 5) (MCM); Lot 141, 2 larvae (instar 5) (MCM); Lot 142, 1 larva (instar 2) (MCM); Lot 1085, 3 larvae (instars 2, 5) (DHH). PUPAE: FLORIDA: MONROE CO.: Lot 137, 1 pupa (MCM); Lot 140, 1 pupa (MCM).

7. *Epargyreus clarus* (Cramer)

Diagnosis. LAST INSTAR LARVA: BODY: Figure 19B, length 19-47mm, A4 transverse width 3.5-9.8mm; green with numerous narrow transverse yellow stripes, a few lines and patches of black microspines on sides, ventral prothorax red, prolegs orange; setae simple, to 0.1mm long on A4 dorsum; spiracles black. HEAD: Figure 22B, dark reddish brown, large yellow eye patches present; transverse width 4.4-5.8mm; sculpturing pebbly; mandibles without teeth; setae simple, to 0.1mm long

at apex, a few ventral setae to 0.7mm; stemmata subequal (Figure 37E); postocciput wide. THORAX: T1 legs red, T2-3 legs tan; shield broad, tan. ABDOMEN: prolegs each with about 145 crochets, irregularly triordinal, arranged in a circle. PUPA: Figures 58A, 61D and 79B, length 18-25.5mm, A3 transverse width 6.3-9.2mm; brown; thoracic spiracle guard distinct; posterior margin of prothorax crenulated; setae simple, to 0.3mm long on head; head rounded; antennae extend slightly caudad of tip of middle leg; proboscis extending to the wing tips; abdomen short; cremaster to 2mm long, blunt with numerous hooked setae in a cluster at the tip (Figures 101D and 112D).

Other Descriptions. Harris 1862 (larva, pupa), Scudder 1881 (larva, pupa), French 1886 (egg, larva, pupa), Scudder 1889a (egg, larva, pupa), Comstock and Comstock 1895 (larva), Mosher 1916 (pupa), Comstock 1927b (egg, larva, pupa), Klots 1951 (larva, pupa), Peterson 1962 (larva), Emmel and Emmel 1973 (egg, larva, pupa), Opler and Krizek 1984 (egg, larva, pupa), Scott 1986 (egg, larva, pupa).

Host Plants. FABACEAE: *Acacia* species (Edwards 1889) [erroneous], *Amorpha californica* (Emmel and Emmel 1973), *Amorpha fruticosa* (Walsh and Riley 1869), *Amphicarpa bracteata* (Scudder 1889a,b), *Apios americana* (Scudder 1889a,b), *Astragalus* species (Tietz 1952), *Cassia marilandica* (Heitzman and Heitzman 1987), *Clitoria mariana* (Hayward 1947), *Desmodium canadense* (Scudder 1889a,b),

Desmodium "dillenii" (Clark 1936) [this name is currently placed under both *D. glabellum* and *D. perplexum*], *Desmodium marilandicum* (Scudder 1889a,b), *Desmodium "michauxii"* (Clark 1936) [I cannot find this name listed in floras of the region], *Desmodium nudiflorum* (Scudder 1889a,b), *Desmodium paniculatum* (Clark 1936), *Desmodium rotundifolium* (Scott 1986), *Erythrina herbacea* (Kendall 1965, oviposition but no larval feeding), *Galactia regularis* (Minno 1992), *Galactia volubilis* (MCM collection), *Gleditsia triacanthos* (Walsh and Riley 1869), *Glycine max* (DHH collection), *Glycyrrhiza lepidota* (McCabe and Post 1977), *Lathyrus palustris* (Moffat 1882), *Lespedeza capitata* (Scudder 1889a,b), *Lotus crassifolius* (Emmel and Emmel 1973), *Lotus grandiflorus* (Lembert 1894), *Lupinus* species (DHH collection), *Phaseolus polystachios* (Fiske 1896), *Phaseolus vulgaris* (Fiske 1896, probably; Lenczewski 1980), *Pueraria lobata* (Sim 1936), *Rhynchosia minima* (Kendall 1965, oviposition but no larval feeding), *Robinia hispida* (French 1878), *Robinia neomexicana* (Scudder 1889a,b), *Robinia pseudoacacia* (Harris 1862), *Robinia viscosa* (Harris 1862), *Wisteria frutescens* (Scudder 1869), *Wisteria sinensis* (Kendall 1965).

Specimens Examined. LARVAE: NO DATA: Lot 1193, 3 larvae (instar 5) (DHH). ARIZONA: COCHISE CO.: Lot 536, 2 larvae (instars 4, 5) (TLM). CALIFORNIA: RIVERSIDE CO.: Lot 583, 1 larva (instar 5) (GRB). FLORIDA: Lot 1172, 1 larva (instar 5) (DHH). ALACHUA CO.: Lot 147, 2 larvae (instar

5) (MCM); Lot 722, 2 larvae (instars 3, 5) (MCM); Lot 723, 1 larva (instar 5) (MCM); Lot 725, 1 larva (instar 5) (MCM); Lot 1173, 1 larva (instar 5) (DHH); Lot 1174, 1 larva (instar 5) (DHH); Lot 1175, 1 larva (instar 4) (DHH); Lot 1176, 1 larva (instar 4) (DHH); Lot 1177, 1 larva (instar 2) (DHH); Lot 1179, 2 larvae (instars 2, 4) (DHH); Lot 1180, 2 larvae (instar 5) (DHH); Lot 1181, 1 larva (instar 5) (DHH); Lot 1185, 1 larva (instar 5) (DHH); Lot 1186, 9 larvae (instars 3, 4, 5) (DHH); Lot 1187, 1 larva (instar 5) (DHH); Lot 1188, 3 larvae (instars 2, 3, 4) (DHH); Lot 1190, 1 larva (instar 2) (DHH); Lot 1192, 1 larva (instar 5) (DHH); Lot 1194, 1 larva (instar 5) (DHH); Lot 1195, 1 larva (instar 5) (DHH); Lot 1197, 1 larva (instar 5) (DHH); Lot 1198, 1 larva (instar 5) (DHH); Lot 1200, 1 larva (instar 5) (DHH); Lot 1201, 1 larva (instar 5) (DHH); Lot 1203, 1 larva (instar 5) (DHH); Lot 1204, 1 larva (instar 2) (DHH); Lot 1205, 1 larva (instar 5) (DHH); Lot 1207, 1 larva (instar 4) (DHH). DUVAL CO.: Lot 721, 1 larva (instar 3) (MCM). GADSDEN CO.: Lot 1170, 2 larvae (instar 5) (DHH). HIGHLANDS CO.: Lot 143, 1 larva (instar 5) (MCM). PUTNAM CO.: Lot 724, 1 larva (instar 5) (MCM); Lot 726, 1 larva (instar 2) (MCM); Lot 1184, 2 larvae (instar 5) (DHH). VOLUSIA CO.: Lot 144, 1 larva (instar 5) (MCM). GEORGIA: TIFT CO.: Lot 1169, 1 larva (instar 5) (DHH). ILLINOIS: Lot 617, 1 larva (instar 5) (SP). INDIANA: KOSCIUSKO CO.: Lot 3, 1 larva (instar 5) (MCM). KANSAS: DOUGLAS CO.: Lot

633, 4 larvae (instars 3, 5) (TCE). MINNESOTA: BECKER CO.: Lot 534, 1 larva (instar 3) (TLM); Lot 537, 1 larva (instar 5) (TLM). MISSOURI: BOONE CO.: Lot 1178, 1 larva (instar 5) (DHH); Lot 1183, 2 larvae (instar 5) (DHH); Lot 1191, 1 larva (instar 5) (DHH). COOPER CO.: Lot 1189, 5 larvae (instars 4, 5) (DHH); Lot 1202, 1 larva (instar 5) (DHH). JACKSON CO.: Lot 556, 3 larvae (instar 5) (JRH); Lot 1196, 3 larvae (instar 5) (DHH); Lot 1199, 4 larvae (instar 5) (DHH). NEW YORK: TOMKINS CO.: Lot 535, 1 larva (instar 5) (TLM). NORTH DAKOTA: SLOPE CO.: Lot 533, 1 larva (instar 5) (TLM). SOUTH CAROLINA: PICKENS CO.: Lot 1206, 1 larva (instar 3) (DHH). VIRGINIA: GILES CO.: Lot 1182, 1 larva (instar 3) (DHH). PUPAE: FLORIDA: ALACHUA CO.: Lot 145, 1 pupa (MCM). KANSAS: DOUGLAS CO.: Lot 633, 1 pupa (TCE). MARYLAND: PRINCE GEORGE'S CO.: Lot 146, 2 pupae (MCM). MISSOURI: JACKSON CO.: Lot 564, 2 pupae (JRH). NEW MEXICO: SANDINAL CO.: Lot 727, 1 pupa (MCM).

8. *Epargyreus exadeus* (Cramer)

Diagnosis. LAST INSTAR LARVA: BODY: length 47mm, A4 transverse width 6.3mm; green with numerous narrow transverse yellow stripes, a few lines and patches of black microspines on sides, ventral prothorax red, prolegs orange; setae simple, to 0.1mm long on A4 dorsum; spiracles dark brown. HEAD: dark reddish brown, large yellow eye patches present; transverse width 5.2mm; sculpturing pebbly; mandibles without teeth; setae simple, to 0.1mm long at

apex, a few ventral setae to 0.7mm; stemmata subequal (Figure 37F); postocciput wide. THORAX: legs tan; shield broad, tan. ABDOMEN: prolegs each with about 175 crochets, irregularly triordinal, arranged in a circle.

Other Descriptions. Draudt 1924 (larva), Moss 1949 (larva), Comstock and Vazquez 1960 (larva, pupa).

Host Plants. FABACEAE: *Cassia* species (Comstock and Vazquez 1960), *Lecythis paraensis* (Moss 1949, probably), *Phaseolus* species (Moss 1949), *Rhynchosia minima* (MCM collection).

Specimens Examined. LARVAE: COLOMBIA: DEPT. VALLE DEL CAUCA: Lot 148, 2 larvae (instars 3, 5) (MCM).

9. *Polygonus leo* (Gmelen)

Diagnosis. LAST INSTAR LARVA: BODY: Figure 19F, length 23-42mm, A4 transverse width 4-7.5mm; green with numerous tiny yellow spots; some setae with expanded tips, < 0.1mm long on A4 dorsum; spiracles tan. HEAD: Figure 22C, pale with two black eye spots on upper face, lateral line black; transverse width 4.3-5.3mm; sculpturing pebbly; mandibles without teeth; setae simple, < 0.1mm long at apex, a few ventral setae to 0.5mm; stemmata subequal (Figure 37G); postocciput moderately wide. THORAX: legs pale; shield indistinct. ABDOMEN: prolegs each with about 180 crochets, irregularly triordinal, arranged in a near circle; suranal plate rounded, unmarked (Figure 45D). PUPA: Figures 58E, 62A, and 80A, length 22-24.5mm, A3 transverse width 7.2-

8.7mm; pale green; thoracic spiracle guard distinct; setae simple, to 0.1mm long on head; head with a short pointed process on cap, anterior margin of eyes with a short point; antennae extend slightly caudad of tip of middle leg; proboscis extending to the wing tips; abdomen short; cremaster to 2.2mm long, blunt with numerous hooked setae in a cluster at the tip (Figures 101E and 112E).

Other Descriptions. Dyar 1897 (larva), Wolcott 1923 (larva), Dethier 1942b (larva), MacNeill 1975 (egg, larva), Minno and Emmel 1993 (larva, pupa).

Host Plants. FABACEAE: *Derris elliptica* (Wolcott 1941), *Lonchocarpus sericeus* (Bates 1935), *Piscidia piscipula* (Dyar 1897), *Pongamia pinnata* (Kimball 1965).

Specimens Examined. LARVAE: FLORIDA: BROWARD CO.: Lot 426, 4 larvae (instars 2, 4, 5) (MCM); Lot 1274, 2 larvae (instars 3, 5) (DHH). MONROE CO.: Lot 423, 1 larva (instar 5) (MCM); Lot 425, 3 larvae (instar 5) (MCM); Lot 427, 1 larva (instar 5) (MCM); Lot 428, 2 larvae (instar 5) (MCM); Lot 730, 1 larvae (instar 5) (MCM); Lot 731, 1 larva (instar 5) (MCM); Lot 732, 1 larva (instar 5) (MCM); Lot 733, 1 larva (instar 5) (MCM); Lot 734, 2 larvae (instar 5) (MCM); Lot 735, 1 larva (instar 5) (MCM), Lot 1273, 1 larva (instar 3) (DHH); Lot 1275, 1 larva (instar 5) (DHH); Lot 1276, 1 larva (instar 5) (DHH). PUPAE: FLORIDA: BROWARD CO.: Lot 426, 1 pupa (MCM). MONROE CO.: Lot 424, 1 pupa (MCM); Lot 425, 1 pupa (MCM).

10. *Polygonus manueli* Bell and W. P. Comstock

No specimens of the immature stages of this neotropical species were located for study. This skipper has rarely been recorded from the U. S.

Other Descriptions. Moss 1949 (larva, pupa).

Host Plants. FABACEAE: *Muellera moniliformis* (Moss 1949).

11. *Chioides catillus* (Cramer)

Diagnosis. LAST INSTAR LARVA: BODY: length 18-33.5mm, A4 transverse width 4.7-7.2mm; preserved specimens pale with some small clusters of black microspines, ventral prothorax red, prolegs orange; some setae with expanded tips, < 0.1mm long on A4 dorsum; spiracles tan. HEAD: Figure 22D, tan, front black, a black W-shaped mark on upper face, stemmatal area black, two black eye spots on lower face, large orange eye patches present; transverse width 4.7-5.6mm; sculpturing pebbly; mandibles without teeth; setae simple, to 0.2mm long at apex, a few ventral setae to 0.8mm; stemmata subequal (Figure 37H); postocciput wide. THORAX: legs reddish; shield broad, dark brown. ABDOMEN: prolegs each with about 140 crochets, irregularly triordinal, arranged in a circle; suranal plate rounded, unmarked (Figure 46A). PUPA: Figures 62B and 80B, length 18.5-23.5mm, A3 transverse width 5.8-7.7mm; brown; thoracic spiracle guard distinct; posterior margin of prothorax crenulated; setae simple, to 0.3mm long on head; head rounded; antennae extend slightly caudad of tip of middle leg; proboscis extending to the wing

tips; abdomen short; cremaster to 2.2mm long, constricted, blunt with numerous hooked setae in a cluster at the tip (Figures 101F and 112F).

Other Descriptions. Hayward 1927a (egg, larva), Comstock and Vazquez 1960 (larva, pupa).

Host Plants. CHENOPodiACEAE: *Chenopodium album* (Hayward 1947) [erroneous]. FABACEAE: *Galactia canescens* (ROK collection), *Glycine max* (Hayward 1941), *Mimosa* species (MacNeill 1975), *Phaseolus atropurpureus* (Kendall 1965), *Rhynchosia minima* (Kendall 1965), *Rhynchosia senna* (Hayward 1927a), *Tephrosia lindheimeri* (Kendall 1965). LAMIACEAE: *Monarda punctata* (Hayward 1947) [erroneous], *Origanum vulgare* (Hayward 1947) [erroneous].

Specimens Examined. LARVAE: TEXAS: CAMERON CO.: Lot 921, 69 larvae (instar 5) (ROK). SAN PATRICIO CO.: Lot 922, 13 larvae (instars 2, 3, 4, 5) (ROK). PUPAE: TEXAS: CAMERON CO.: Lot 921, 6 pupae (ROK). SAN PATRICIO CO.: Lot 922, 1 pupa (ROK).

12. *Chioides zilpa* (Butler)

The immature stages of this species are undescribed. No specimens were located for study.

Host Plants. FABACEAE: *Nissolia schottii* (Bailowitz and Brock 1991, possibly), *Phaseolus* species (Beutelspacher 1980), *Rhynchosia* species (Beutelspacher 1980), *Tephrosia* species (Beutelspacher 1980).

13. *Aguna asander* (Hewitson)

Little is known of the biology of this neotropical species, except that the larvae probably feed on leguminous plants (da Costa Lima 1936).

14. *Aguna claxon* Evans

Nothing is known of the biology of this neotropical species.

15. *Typhedanus undulatus* (Hewitson)

Diagnosis. LAST INSTAR LARVA: BODY: length 18-24mm, A4 transverse width 3.8-6.2mm; preserved specimens brownish; some setae with expanded tips, to 0.1mm long on A4 dorsum; spiracles tan. HEAD: Figure 22E, black, large yellow eye patches present; transverse width 4.7-5.6mm; sculpturing pebbly; mandibles without teeth; setae branching, to 0.1mm long at apex, a few ventral setae to 0.5mm; stemmata subequal (Figure 37I); postocciput wide. THORAX: legs tan; shield narrow, a brown line between the annuli. ABDOMEN: prolegs each with about 60 crochets, irregularly triordinal, arranged in a near circle; suranal plate rounded, unmarked (Figure 46B).

Other Descriptions. Hayward 1931 (egg, larva, pupa), Hoffmann 1932 (larva, pupa), Moss 1949 (larva, pupa).

Host Plants. FABACEAE: *Cassia alata* (Moss 1949), *Cassia bicapsularis* (FSCA collection), *Cassia corymbosa* (Hayward 1931), *Cassia occidentalis* (Moss 1949), *Cassia reticulata* (Moss 1949), *Cassia tora* (Moss 1949).

Specimens Examined. LARVAE: TEXAS: HIDALGO CO.: Lot 1003, 2 larvae (instar 5) (FSCA).

16. *Polythrix mexicana* H. A. Freeman

Diagnosis. LAST INSTAR LARVA: BODY: length 19-25.5mm, A4 transverse width 4.6-5mm; preserved specimens pale, reticulated with yellow, subdorsal line a chain of orange spots connected by a narrow yellow line on T3-A9; some setae with expanded tips, < 0.1mm long on A4 dorsum; spiracles pale. HEAD: Figure 22F, pale, lateral stripe yellow anteriorly, black posteriorly, two black spots on upper face, posterior black; transverse width 3.7-4.3mm; sculpturing pebbly; mandibles without teeth; setae simple, < 0.1mm long at apex, a few ventral setae to 0.5mm; stemmata subequal (Figure 37J); postocciput moderately wide. THORAX: legs pale; shield indistinct. ABDOMEN: prolegs each with about 175 crochets, irregularly triordinal, arranged in a near circle; suranal plate rounded, unmarked (Figure 46C). PUPA: Figures 62C and 81A, length 19mm, A3 transverse width 4.8-5.7mm; brown; thoracic spiracle guard distinct; posterior margin of prothorax crenulated; setae simple, to 0.1mm long on head; head with a short pointed process on cap; antennae extend slightly caudad of tip of middle leg; proboscis extending to the wing tips; abdomen moderately long; cremaster to 2.1mm long, blunt with numerous hooked setae in a cluster at the tip (Figures 101G and 113A).

Host Plants. FABACEAE: *Amerimnnon granadillo* (Kendall and McGuire 1975), *Ichtyomethia communis* (Kendall and McGuire 1975).

Specimens Examined. LARVAE: MEXICO: TAMAULIPAS: Lot 967, 4 larvae (instar 5) (ROK); Lot 968, 2 larvae (instar 5) (ROK). PUPAE: MEXICO: TAMAULIPAS: Lot 967, 3 pupae (ROK).

17. *Polythrix octomaculata* (Sepp)

No immature specimens of this species were located for study. The larva and pupa stages were briefly described by Draudt (1924) and Moss (1949).

Host Plants. FABACEAE: *Muellera moniliformis* (Moss 1949), *Pterocarpus draco* (Riley 1975), *Pterocarpus indicus* (Draudt 1924), *Toluifera perreirae* (Scott 1986).

18. *Polythrix procera* (Plötz)

Diagnosis. EGG: height 1.7mm, width 0.8mm, 14 ribs. LAST INSTAR LARVA: BODY: length 24.5mm, A4 transverse width 6.5mm; preserved specimens pale, subdorsal line broken into a row of red spots on A1-7, large red patches around the spiracles, A1-8 red ventrally; some setae with expanded tips, to 0.1mm long on A4 dorsum; spiracles pale. HEAD: Figure 23A, reddish brown, paler toward the apex, large yellowish eye patches present, stemmatal area black, vertex deeply cleft; transverse width 4.5mm; sculpturing pebbly; mandibles without teeth; setae simple, to 0.1mm long at apex, a few ventral setae to 0.5mm; stemmata subequal

(Figure 37K); postocciput wide. THORAX: legs brown; shield broad, tan. ABDOMEN: crochets irregularly triordinal, arranged in a circle.

Host Plants. COMBRETACEAE: *Laguncularia racemosa* (Kendall and McGuire 1975), *Terminalia catappa* (Kendall and McGuire 1975).

Specimens Examined. EGGS: MEXICO: TAMAULIPAS: Lot 969, 1 egg (ROK). LARVAE: MEXICO: TAMAULIPAS: Lot 969, 2 larvae (instars 4, 5) (ROK).

19. *Zestusa dorus* (Edwards)

No immature specimens of this southwestern species were located for study. Klots (1971) briefly described the egg, larva, and pupa.

Host Plants. FAGACEAE: *Quercus alba* (Klots 1971, in lab), *Quercus arizonica* (Klots 1971, associated with; MacNeill 1975), *Quercus emoryi* (Klots 1971), *Quercus gambelii* (Klots 1971, in lab).

20. *Codatractus alcaeus* (Hewitson)

Diagnosis. LAST INSTAR LARVA: BODY: length 27-38.5mm, A4 transverse width 5.5-8.5mm; preserved specimens pale with numerous tiny yellow spots, subdorsal line broken into a row of round yellow spots on A1-8; setae simple, to 0.2mm long on A4 dorsum; spiracles tan. HEAD: Figure 23B, reddish brown, lower half of face black, large yellow eye patches present; transverse width 5.7-6.4mm; sculpturing pebbly; mandibles without teeth; setae simple, to 0.2mm long at

apex, a few ventral setae to 0.7mm; stemmata subequal (Figure 37L); postocciput moderately wide. THORAX: legs tan; shield broad, tan. ABDOMEN: prolegs each with about 140 crochets, irregularly triordinal, arranged in a circle or near circle; suranal plate rounded, unmarked (Figure 46D). PUPA: Figures 62D and 81B, length 22mm, A3 transverse width 7.7mm; brown; thoracic spiracle guard distinct; posterior margin of prothorax crenulated; setae simple, to 0.1mm long on head; head rounded; antennae extend slightly caudad of tip of middle leg; proboscis extending to the wing tips; abdomen short; cremaster to 1.9mm long, blunt with numerous hooked setae in a cluster at the tip (Figures 101H and 113B).

Host Plants. FABACEAE: *Amerimnon granadillo* (Kendall and McGuire 1975), *Ichtyomethia communis* (Kendall and McGuire 1975).

Specimens Examined. LARVAE: MEXICO: TAMAULIPAS: Lot 924, 2 larvae (instars 3, 5) (ROK). SAN LUIS POTOSI: Lot 925, 2 larvae (instar 5) (ROK). PUPAE: MEXICO: TAMAULIPAS: Lot 924, 1 pupa (ROK). SAN LUIS POTOSI: Lot 925, 1 pupa (ROK).

21. *Codatractus melon* (Godman and Salvin)

Nothing is known of the biology of this neotropical species.

22. *Codatractus arizonensis* (Skinner)

Diagnosis. LAST INSTAR LARVA: BODY: length 27-27.5mm, A4 transverse width 6.4mm; preserved specimens pale with

numerous tiny yellow spots, subdorsal line broken into a row of rectangular yellow spots on T2-A8; setae simple, to 0.2mm long on A4 dorsum; spiracles tan. HEAD: Figure 23C, pale brown, front black, large yellow eye patches present; transverse width 4.8-5mm; sculpturing pebbly; mandibles without teeth; setae simple, to 0.2mm long at apex, a few ventral setae to 0.6mm; stemmata subequal (Figure 38A); postocciput moderately wide. THORAX: legs tan; shield broad, tan. ABDOMEN: prolegs each with about 80 crochets, irregularly triordinal, arranged in a near circle. PUPA: Figures 62E and 81C, length 18mm, A3 transverse width 5.8mm; dark reddish brown; thoracic spiracle guard distinct; posterior margin of prothorax crenulated; setae simple, to 0.1mm long on head; head rounded; antennae extend slightly caudad of tip of middle leg; proboscis extending to the wing tips; abdomen short; cremaster to 1.4mm long, constricted, blunt with numerous hooked setae in a cluster at the tip (Figures 101I and 113C).

Host Plants. FABACEAE: *Eysenhardtia orthocarpa* (Bailowitz and Brock 1991), *Eysenhardtia texana* (ROK collection).

Specimens Examined. LARVAE: TEXAS: BREWSTER CO.: Lot 926, 11 larvae (instars 3, 5) (ROK). PUPAE: TEXAS: BREWSTER CO.: Lot 926, 2 pupae (ROK).

23. *Urbanus proteus* (Linnaeus)

Diagnosis. EGG: Figures 3A and 4A, height 0.9-1mm, width 0.8-0.9mm, 11-12 ribs, yellow. LAST INSTAR LARVA: BODY:

Figure 19D, length 17-41mm, A4 transverse width 3.5-7.8mm; green, heart line darkened with black microspines, subdorsal line narrow, yellow, widening and becoming orange on A8-10, small scattered patches of black microspines present, ventral prothorax red, prolegs orange; some setae with blunt tips, to 0.2mm long on A4 dorsum; spiracles tan. HEAD: Figure 23D, light brown, lower face blackish, large orange or reddish eye patches present, posterior black; transverse width 4-5.3mm; sculpturing pebbly; mandibles without teeth; setae simple, to 0.1mm long at apex, a few ventral setae to 0.5mm; stemmata subequal (Figure 38B); postocciput wide. THORAX: T1 legs dark brown, T2-3 legs tan; shield broad, dark brown. ABDOMEN: prolegs each with about 115 crochets, irregularly triordinal, arranged in a circle; suranal plate rounded, unmarked (Figure 46E). PUPA: Figures 58C, 62F and 82A, length 18.5-26.5mm, A3 transverse width 5.4-8mm; brown; thoracic spiracle guard distinct; posterior margin of prothorax crenulated; setae simple, to 0.3mm long on head; head rounded; antennae extend slightly caudad of tip of middle leg; proboscis extending to the wing tips; abdomen short; cremaster to 1.5mm long, blunt with numerous hooked setae in a cluster at the tip (Figures 102A and 113D).

Other Descriptions. Edwards and Chapman 1879 (larva, pupa), Comstock 1881 (larva, pupa), Scudder 1889a (egg, larva, pupa), Quaintance 1898 (egg, larva, pupa), Chittenden 1902 (egg, larva, pupa), Watson 1919 (larva), Comstock 1932b

(egg), Moss 1949 (larva, pupa), Emmel and Emmel 1973 (larva, pupa), Heppner 1975 (larva), Pyle 1981 (egg, larva, pupa), Young 1985 (egg, larva, pupa), Toliver 1987 (larva), Minno and Emmel 1993 (egg, larva, pupa).

Host Plants. ASTERACEAE: *Camara amarella* (Moss 1949) [questionable], *Clibadium erosum* (USNM collection) [questionable]. BRASSICACEAE: *Brassica oleracea* (Comstock 1881) [erroneous], *Brassica rapa* (Comstock 1881) [erroneous], *Brassica* species (Scudder 1889b) [erroneous], *Raphanus sativus* (MCM observation, oviposition and larvae cut shelters, but refused to eat this plant in the lab). CANNACEAE: *Canna* species (Hayward 1941) [erroneous]. FABACEAE: *Alysicarpus vaginalis* (MCM collection), *Amphicarpa bracteata* (Opler and Krizek 1984), *Bauhinia* species (Hayward 1941), *Centrosema floridanum* (Minno 1992), *Centrosema pubescens* (USNM collection), *Centrosema virginianum* (MCM collection), *Clitoria mariana* (Scudder 1872), *Clitoria ternatea* (Scudder 1889a,b), *Crotalaria spectabilis* (MCM observation, oviposition and larvae cut shelters, but refused to eat this plant), *Crotalaria* species (Fennah 1947) [questionable], *Desmodium batocaulon* (Bailowitz and Brock 1991), *Desmodium canescens* (Chittenden 1902), *Desmodium floridanum* (MCM observation), *Desmodium incanum* (Minno 1992), *Desmodium neomexicanum* (Kendall 1976), *Desmodium paniculatum* (MCM collection), *Desmodium tortuosum* (Quaintance 1898), *Desmodium viridiflorum* (Scudder 1889a,b),

Galactia regularis (MCM collection), *Galactia striata* (Minno and Emmel 1993), *Glycine max* (Tietz 1952), *Macroptilium lathyroides* (Wolcott 1923), *Mucuna* species (Young 1985), *Phaseolus aureus* (Bruner et al. 1945), *Phaseolus limensis* (Wolcott 1936), *Phaseolus polystachios* (Edwards and Chapman 1879), *Phaseolus semierectus* (Hayward 1947), *Phaseolus vulgaris* (Comstock 1881), *Pisum sativum* (Comstock 1944), *Prosopis glandulosa* var. *torreyana* (Tietz 1952), *Prosopis* species (Comstock 1927b), *Pueraria lobata* (MCM collection), *Rhynchosia minima* (MCM collection), *Vigna luteola* (Minno 1992), *Vigna sinensis* (Tietz 1952), *Vigna* species (Chittenden 1902), *Wisteria floribunda* (Hayward 1941), *Wisteria frutescens* (Scudder 1889a,b), *Wisteria sinensis* (Gerberg and Arnett 1989). LAMIACEAE: (Kimball 1965) [erroneous]. MALPIGHIACEAE: *Stigmaphyllon lingulatum* (Wolcott 1923) [erroneous]. ROSACEAE: *Prunus* species (Kimball 1965) [erroneous].

Specimens Examined. EGGS: FLORIDA: ALACHUA CO.: Lot 1322, 24 eggs (DHH); Lot 1417, 14 eggs (DHH); Lot 1531, 1 egg (MCM); Lot 1540, 2 eggs (MCM); Lot 1541, 1 egg (MCM). LARVAE: COLOMBIA: DEPT. VALLE DEL CAUCA: Lot 502, 2 larvae (instar 5) (MCM). COSTA RICA: Lot 1484, 1 larva (instar 4) (DHH). HONDURAS: DEPT. COMAYAGUA: Lot 619, 1 larva (instar 3) (SP). JAMAICA: Lot 1081, 8 larvae (instars 2, 3, 4) (DHH). PUERTO RICO: Lot 861, 1 larva (instar 5) (USNM); Lot 862, 1 larva (instar 5) (USNM).

CALIFORNIA: RIVERSIDE CO.: Lot 584, 1 larva (instar 5) (GRB). FLORIDA: Lot 494, 2 larvae (instar 5) (MCM); Lot 1372, 1 larva (instar 5) (DHH); Lot 1454, 6 larvae (instar 5) (DHH); Lot 1479, 1 larva (instar 5) (DHH). ALACHUA CO.: Lot 489, 1 larva (instar 5) (MCM); Lot 498, 2 larvae (instar 5) (MCM); Lot 500, 1 larva (instar 5) (MCM); Lot 503, 1 larva (instar 5) (MCM); Lot 511, 1 larva (instar 5) (MCM); Lot 757, 1 larva (instar 5) (MCM); Lot 761, 3 larvae (instars 4, 5) (MCM); Lot 762, 1 larva (instar 5) (MCM); Lot 764, 1 larva (instar 5) (MCM); Lot 1073, 2 larvae (instar 3) (DHH); Lot 1074, 2 larvae (instar 2) (DHH); Lot 1077, 1 larva (instar 3) (DHH); Lot 1287, 3 larvae (instar 3) (DHH); Lot 1292, 1 larva (instar 4) (DHH); Lot 1293, 8 larvae (instars 4, 5) (DHH); Lot 1294, 2 larvae (instar 5) (DHH); Lot 1295, 16 larvae (instars 3, 4, 5) (DHH); Lot 1296, 18 larvae (instars 4, 5) (DHH); Lot 1297, 8 larvae (instars 4, 5) (DHH); Lot 1298, 2 larvae (instar 5) (DHH); Lot 1299, 18 larvae (instars 1, 2, 3, 4, 5) (DHH); Lot 1300, 11 larvae (instars 3, 4, 5) (DHH); Lot 1301, 2 larvae (instar 4) (DHH); Lot 1304, 5 larvae (instar 5) (DHH); Lot 1307, 1 larva (instar 4) (DHH); Lot 1308, 1 larva (instar 5) (DHH); Lot 1309, 5 larvae (instars 4, 5) (DHH); Lot 1310, 1 larva (instar 5) (DHH); Lot 1311, 5 larvae (instars 4, 5) (DHH); Lot 1312, 1 larva (instar 5) (DHH); Lot 1313, 7 larvae (instars 1, 2, 3) (DHH); Lot 1314, 1 larva (instar 5) (DHH); Lot 1315, 1 larva (instar 5) (DHH); Lot 1317, 1 larva

(instar 5) (DHH); Lot 1318, 2 larvae (instar 2) (DHH); Lot 1319, 9 larvae (instars 4, 5) (DHH); Lot 1322, 9 larvae (instars 1, 2, 3, 4) (DHH); Lot 1323, 2 larvae (instars 3, 5) (DHH); Lot 1324, 1 larva (instar 5) (DHH); Lot 1325, 5 larvae (instars 4, 5) (DHH); Lot 1326, 1 larva (instar 5) (DHH); Lot 1327, 2 larvae (instar 5) (DHH); Lot 1328, 4 larvae (instars 4, 5) (DHH); Lot 1329, 1 larva (instar 5) (DHH); Lot 1330, 3 larvae (instar 3) (DHH); Lot 1333, 1 larva (instar 5) (DHH); Lot 1334, 1 larva (instar 5) (DHH); Lot 1335, 2 larvae (instar 5) (DHH); Lot 1336, 1 larva (instar 5) (DHH); Lot 1337, 3 larvae (instar 5) (DHH); Lot 1338, 1 larva (instar 5) (DHH); Lot 1339, 1 larva (instar 4) (DHH); Lot 1340, 1 larva (instar 4) (DHH); Lot 1341, 1 larva (instar 5) (DHH); Lot 1342, 1 larva (instar 5) (DHH); Lot 1344, 1 larva (instar 5) (DHH); Lot 1345, 1 larva (instar 3) (DHH); Lot 1346, 3 larvae (instars 2, 3) (DHH); Lot 1347, 1 larva (instar 5) (DHH); Lot 1348, 1 larva (instar 5) (DHH); Lot 1349, 2 larvae (instar 5) (DHH); Lot 1350, 2 larvae (instar 5) (DHH); Lot 1352, 1 larva (instar 3) (DHH); Lot 1353, 1 larva (instar 5) (DHH); Lot 1355, 1 larva (instar 5) (DHH); Lot 1356, 1 larva (instar 5) (DHH); Lot 1358, 1 larva (instar 5) (DHH); Lot 1360, 1 larva (instar 5) (DHH); Lot 1361, 1 larva (instar 5) (DHH); Lot 1362, 1 larva (instar 5) (DHH); Lot 1363, 2 larvae (instars 4, 5) (DHH); Lot 1364, 1 larva (instar 5) (DHH); Lot 1366, 2 larvae (instar 5) (DHH); Lot 1367, 1 larva (instar 5) (DHH); Lot 1368, 3 larvae

(instars 4, 5) (DHH); Lot 1369, 3 larvae (instar 5) (DHH); Lot 1370, 5 larvae (instars 4, 5) (DHH); Lot 1371, 1 larva (instar 4) (DHH); Lot 1373, 4 larvae (instars 3, 5) (DHH); Lot 1374, 2 larvae (instar 4) (DHH); Lot 1375, 1 larva (instar 5) (DHH); Lot 1376, 1 larva (instar 5) (DHH); Lot 1377, 2 larvae (instar 5) (DHH); Lot 1379, 4 larvae (instars 2, 3, 4) (DHH); Lot 1380, 1 larva (instar 4) (DHH); Lot 1381, 1 larva (instar 3) (DHH); Lot 1382, 3 larvae (instars 4, 5) (DHH); Lot 1383, 1 larva (instar 5) (DHH); Lot 1384, 1 larva (instar 5) (DHH); Lot 1385, 2 larvae (instar 5) (DHH); Lot 1386, 1 larva (instar 5) (DHH); Lot 1387, 1 larva (instar 5) (DHH); Lot 1388, 1 larva (instar 5) (DHH); Lot 1389, 1 larva (instar 5) (DHH); Lot 1390, 1 larva (instar 5) (DHH); Lot 1391, 10 larvae (instars 2, 3, 4) (DHH); Lot 1392, 1 larva (instar 5) (DHH); Lot 1393, 1 larva (instar 5) (DHH); Lot 1394, 4 larvae (instars 1, 2, 3) (DHH); Lot 1395, 1 larva (instar 4) (DHH); Lot 1396, 4 larvae (instar 2) (DHH); Lot 1397, 2 larvae (instar 4) (DHH); Lot 1398, 2 larvae (instar 3) (DHH); Lot 1400, 4 larvae (instar 5) (DHH); Lot 1403, 1 larva (instar 5) (DHH); Lot 1404, 2 larvae (instar 3) (DHH); Lot 1406, 1 larva (instar 5) (DHH); Lot 1407, 1 larva (instar 4) (DHH); Lot 1409, 1 larva (instar 4) (DHH); Lot 1410, 7 larvae (instar 4) (DHH); Lot 1411, 1 larva (instar 5) (DHH); Lot 1412, 3 larvae (instars 4, 5) (DHH); Lot 1414, 5 larvae (instars 4, 5) (DHH); Lot 1415, 1 larva (instar 5) (DHH); Lot 1416, 2 larvae (instars

4, 5) (DHH); Lot 1417, 8 larvae (instars 2, 3, 4, 5) (DHH); Lot 1418, 5 larvae (instars 3, 4, 5) (DHH); Lot 1421, 1 larva (instar 5) (DHH); Lot 1422, 1 larva (instar 5) (DHH); Lot 1423, 4 larvae (instars 4, 5) (DHH); Lot 1424, 1 larva (instar 5) (DHH); Lot 1426, 2 larvae (instar 5) (DHH); Lot 1429, 1 larva (instar 5) (DHH); Lot 1432, 1 larva (instar 4) (DHH); Lot 1433, 1 larva (instar 5) (DHH); Lot 1434, 1 larva (instar 5) (DHH); Lot 1436, 1 larva (instar 5) (DHH); Lot 1438, 1 larva (instar 5) (DHH); Lot 1439, 3 larvae (instar 5) (DHH); Lot 1440, 3 larvae (instars 3, 4) (DHH); Lot 1441, 1 larva (instar 5) (DHH); Lot 1442, 1 larva (instar 4) (DHH); Lot 1443, 5 larvae (instars 3, 5) (DHH); Lot 1445, 4 larvae (instars 3, 5) (DHH); Lot 1448, 2 larvae (instar 5) (DHH); Lot 1449, 2 larvae (instar 5) (DHH); Lot 1451, 1 larva (instar 4) (DHH); Lot 1452, 1 larva (instar 2) (DHH); Lot 1453, 2 larvae (instars 4, 5) (DHH); Lot 1455, 5 larvae (instars 4, 5) (DHH); Lot 1456, 2 larvae (instar 5) (DHH); Lot 1457, 2 larvae (instar 5) (DHH); Lot 1458, 3 larvae (instar 5) (DHH); Lot 1459, 1 larva (instar 5) (DHH); Lot 1460, 1 larva (instar 5) (DHH); Lot 1462, 1 larva (instar 5) (DHH); Lot 1463, 1 larva (instar 5) (DHH); Lot 1465, 1 larva (instar 5) (DHH); Lot 1466, 3 larvae (instars 3, 5) (DHH); Lot 1469, 1 larva (instar 2) (DHH); Lot 1470, 2 larvae (instars 3, 5) (DHH); Lot 1471, 1 larva (instar 5) (DHH); Lot 1472, 4 larvae (instars 2, 3) (DHH); Lot 1473, 1 larva (instar 5) (DHH); Lot 1474, 1 larva (instar 3) (DHH); Lot

1475, 1 larva (instar 4) (DHH); Lot 1476, 2 larvae (instars 3, 4) (DHH); Lot 1477, 5 larvae (instars 3, 4, 5) (DHH); Lot 1478, 2 larvae (instar 3) (DHH); Lot 1480, 7 larvae (instars 4, 5) (DHH); Lot 1481, 2 larvae (instars 4, 5) (DHH); Lot 1485, 1 larva (instar 4) (DHH); Lot 1487, 3 larvae (instars 2, 4) (DHH); Lot 1488, 2 larvae (instars 3, 5) (DHH); Lot 1489, 1 larva (instar 4) (DHH); Lot 1490, 4 larvae (instars 4, 5) (DHH); Lot 1493, 2 larvae (instar 4) (DHH); Lot 1507, 1 larva (instar 5) (MCM); Lot 1531, 2 larvae (instar 2) (MCM); Lot 1540, 4 larvae (instar 1) (MCM); Lot 1542, 8 larvae (instars 1, 2) (MCM). BRADFORD CO.: Lot 1425, 1 larva (instar 5) (DHH); Lot 1447, 3 larvae (instars 4, 5) (DHH); Lot 1467, 8 larvae (instars 4, 5) (DHH); Lot 1468, 4 larvae (instar 5) (DHH). BROWARD CO.: Lot 505, 6 larvae (instar 3, 5) (MCM); Lot 507, 2 larvae (instar 5) (MCM); Lot 1357, 1 larva (instar 5) (DHH). COLUMBIA CO.: Lot 1430, 1 larva (instar 4) (DHH). DADE CO.: Lot 546, 2 larvae (instar 5) (TLM); Lot 1076, 1 larva (instar 3) (DHH); Lot 1303, 2 larvae (instar 5) (DHH); Lot 1401, 5 larvae (instar 3, 4, 5) (DHH); Lot 1428, 1 larva (instar 5) (DHH); Lot 1483, 1 larva (instar 4) (DHH). GADSDEN CO.: Lot 1331, 1 larva (instar 5) (DHH); Lot 1354, 2 larvae (instars 4, 5) (DHH); Lot 1359, 1 larva (instar 4) (DHH); Lot 1378, 1 larva (instar 5) (DHH); Lot 1431, 1 larva (instar 5) (DHH); Lot 1435, 1 larva (instar 4) (DHH); Lot 1437, 1 larva (instar 5) (DHH). HARDEE CO.: Lot 1302, 2 larvae (instars 2, 3)

(DHH). HIGHLANDS CO.: Lot 491, 2 larvae (instars 3, 5) (MCM); Lot 492, 2 larvae (instar 5) (MCM); Lot 510, 2 larvae (instar 5) (MCM). HILLSBOROUGH CO.: Lot 1461, 1 larva (instar 5) (DHH). LEON CO.: Lot 755, 2 larvae (instar 5) (MCM). LEVY CO.: Lot 1316, 3 larvae (instar 5) (DHH); Lot 1320, 1 larva (instar 3) (DHH); Lot 1343, 1 larva (instar 3) (DHH); Lot 1351, 1 larva (instar 5) (DHH); Lot 1399, 2 larvae (instar 5) (DHH). LIBERTY CO.: Lot 1413, 3 larvae (instar 5) (DHH). MADISON CO.: Lot 1075, 1 larva (instar 3) (DHH); Lot 1332, 1 larva (instar 5) (DHH). MANATEE CO.: Lot 1365, 2 larvae (instar 2) (DHH); Lot 1405, 3 larvae (instars 3, 4, 5) (DHH); Lot 1419, 6 larvae (instars 1, 2, 3) (DHH); Lot 1420, 2 larvae (instar 5) (DHH); Lot 1491, 4 larvae (instar 4) (DHH). MARION CO.: Lot 495, 1 larva (instar 4) (MCM); Lot 1305, 1 larva (instar 4) (DHH); Lot 1444, 1 larva (instar 3) (DHH). MONROE CO.: Lot 504, 1 larva (instar 5) (MCM); Lot 1486, 1 larva (instar 4) (DHH). NASSAU CO.: Lot 760, 1 larva (instar 5) (MCM). ORANGE CO.: Lot 1408, 1 larva (instar 4) (DHH). POLK CO.: Lot 497, 3 larvae (instars 3, 5) (MCM); Lot 506, 2 larvae (instar 5) (MCM); Lot 1482, 1 larva (instar 5) (DHH). PUTNAM CO.: Lot 496, 1 larva (instar 5) (MCM); Lot 501, 2 larvae (instar 5) (MCM); Lot 509, 1 larva (instar 5) (MCM); Lot 512, 1 larva (instar 5) (MCM); Lot 753, 2 larvae (instar 5) (MCM); Lot 758, 1 larva (instar 5) (MCM); Lot 759, 1 larva (instar 5) (MCM); Lot 1321, 4 larvae (instars 4, 5) (DHH); Lot 1450, 1

larva (instar 4) (DHH). ST. JOHNS CO.: Lot 490, 1 larva (instar 5) (MCM); Lot 499, 2 larvae (instar 5) (MCM). ST. LUCIE CO.: Lot 784, 1 larva (instar 3) (USNM). GEORGIA: COFFEE CO.: Lot 1446, 1 larva (4 instar) (DHH). PUPAE: FLORIDA: Lot 1402, 1 pupa (DHH). ALACHUA CO.: Lot 508, 2 pupae (MCM); Lot 754, 2 pupae (MCM); Lot 1304, 1 pupa (DHH); Lot 1306, 1 pupa (DHH); Lot 1362, 1 pupa (DHH); Lot 1417, 1 pupa (DHH); Lot 1438, 1 pupa (DHH); Lot 1477, 1 pupa (DHH). DADE CO.: Lot 1401, 1 pupa (DHH). HIGHLANDS CO.: Lot 492, 2 pupae (MCM); Lot 630, 3 pupae (MCM). MANATEE CO.: Lot 1464, 1 pupa (DHH). PUTNAM CO.: Lot 756, 1 pupa (MCM); Lot 763, 1 pupa (MCM). ST. JOHNS CO.: Lot 490, 1 pupa (MCM); Lot 493, 1 pupa (MCM).

24. *Urbanus pronta* Evans

A single specimen of this neotropical species has been reported from Texas, but Scott (1986) corrected the identification to *Urbanus pronus*. Nothing is known of the biology of either species.

25. *Urbanus esmeraldus* (Butler)

Diagnosis. EGG: height 1mm, width 0.9mm, 12 ribs. LAST INSTAR LARVA: BODY: length 27mm, A4 transverse width 5.1mm; preserved specimen pale, subdorsal line faintly red, scattered patches of black microspines present, ventral prothorax and prolegs red; some setae with blunt tips, to 0.1mm long on A4 dorsum; spiracles tan. HEAD: brown, paler toward the apex, large orange eye patches present;

transverse width 4.6mm; sculpturing pebbly, small spines at apex; mandibles without teeth; setae simple, to 0.2mm long at apex, a few ventral setae to 0.5mm; stemmata subequal (Figure 38C); postocciput wide. THORAX: legs tan; shield broad, tan. ABDOMEN: prolegs each with about 95 crochets, irregularly triordinal, arranged in a circle. PUPA: Figure 63A and 82B, length 20.5-23mm, A3 transverse width 6.7-7.2mm; brown; thoracic spiracle guard distinct; posterior margin of prothorax crenulated; setae simple, to 0.4mm long on head; head rounded; antennae extend slightly caudad of tip of middle leg; proboscis extending to the wing tips; abdomen short; cremaster to 1.7mm long, blunt with numerous hooked setae in a cluster at the tip (Figure 102B and 113E).

Other Descriptions. Moss 1949 (larva).

Host Plants. FABACEAE: *Desmodium neomexicanum* (Kendall 1976).

Specimens Examined. EGGS: MEXICO: TAMAULIPAS: Lot 985, 1 egg (ROK). LARVAE: MEXICO: TAMAULIPAS: Lot 985, 3 larvae (instars 2, 4, 5) (ROK). PUPAE: MEXICO: TAMAULIPAS: Lot 985, 2 pupae (ROK).

26. *Urbanus dorantes* (Stoll)

Diagnosis. EGG: height 0.8-0.9mm, width 0.7-0.8mm, 12-13 ribs, green. LAST INSTAR LARVA: BODY: Figure 19E, length 20.5-36.5mm, A4 transverse width 5-6.5mm; color variable, green to pinkish brown, heart line dark, subdorsal line outlined by dark bands, constricted at the segmental

boundaries, small scattered patches of black microspines present, ventral prothorax red; some setae with slightly expanded tips, to 0.1mm long on A4 dorsum; spiracles dark brown. HEAD: Figure 23E, black; transverse width 4.1-4.9mm; sculpturing pebbly, small spines at apex; mandibles without teeth; setae simple, to 0.3mm long at apex, a few ventral setae to 0.5mm; stemmata subequal (Figure 38D); postocciput wide. THORAX: T1 legs dark brown, T2-3 legs pale; shield broad, dark brown. ABDOMEN: prolegs each with about 95 crochets, irregularly triordinal, arranged in a circle. PUPA: Figures 63B and 82C, length 18.5-25mm, A3 transverse width 5.9-7.2mm; brown with darker spots and markings; thoracic spiracle guard distinct; posterior margin of prothorax crenulated; setae simple, to 0.2mm long on head; head rounded; antennae extend slightly caudad of tip of middle leg; proboscis extending to the wing tips; abdomen moderately long; cremaster to 1.9mm long, blunt with numerous hooked setae in a cluster at the tip (Figures 102C and 113F).

Other Descriptions. Dethier 1942b (egg, larva), Moss 1949 (larva, pupa), Comstock and Vazquez 1960 (egg, larva), Heppner 1975 (larva), Minno and Emmel 1993 (egg, larva, pupa)

Host Plants. FABACEAE: *Clitoria mariana* (Bailowitz and Brock 1991), *Desmodium batocaulon* (Bailowitz and Brock 1991), *Desmodium incanum* (Minno 1992), *Desmodium*

neomexicanum (Bailowitz and Brock 1991), *Desmodium tortuosum* (Heppner 1975), *Phaseolus vulgaris* (Dethier 1942b), *Vigna luteola* (MCM observation).

Specimens Examined. EGGS: FLORIDA: ALACHUA CO.: Lot 1532, 4 eggs (MCM). LARVAE: FLORIDA: ALACHUA CO.: Lot 751, 3 larvae (instar 3, 5) (MCM). BROWARD CO.: Lot 517, 1 larva (instar 5) (MCM). DADE CO.: Lot 516, 1 larva (instar 5) (MCM); Lot 750, 1 larva (instar 5) (MCM). HIGHLANDS CO.: Lot 513, 2 larvae (instar 5) (MCM); Lot 514, Lot 515, 1 larva (instar 5) (MCM). SARASOTA CO.: Lot 1492, 1 larva (instar 5) (DHH). PUPAE: FLORIDA: ALACHUA CO.: Lot 752, 2 pupae (MCM). BROWARD CO.: Lot 515, 1 pupa (MCM). HIGHLANDS CO.: Lot 513, 2 pupae (MCM); Lot 514, 2 pupae (MCM).

27. *Urbanus teleus* (Hübner)

Diagnosis. EGG: height 1-1.1mm, width 0.6-0.8mm, 15-16 ribs. LAST INSTAR LARVA: BODY: length 20-43mm, A4 transverse width 5.1-7.8mm; preserved specimens brownish; some setae with expanded tips, to 0.2mm long on A4 dorsum; spiracles dark brown. HEAD: dark brown; transverse width 4.3-4.8mm; sculpturing pebbly, small spines at apex; mandibles without teeth; setae simple, to 0.3mm long at apex, a few ventral setae to 0.6mm; stemmata subequal (Figure 38E); postocciput wide. THORAX: legs dark brown; shield broad, dark brown. ABDOMEN: prolegs each with about 100 crochets, irregularly triordinal, arranged in a circle.

PUPA: Figures 63C and 83A, length 18-23.5mm, A3 transverse width 5.8-8.3mm; brown with darker spots and markings; thoracic spiracle guard distinct; posterior margin of prothorax crenulated; setae simple, < 0.1mm long on head; head rounded; antennae extend slightly caudad of tip of middle leg; proboscis extending to the wing tips; abdomen short; cremaster to 2.3mm long, blunt with numerous hooked setae in a cluster at the tip (Figures 102D and 113G).

Other Descriptions. Moss 1949 (larva).

Host Plants. POACEAE: *Panicum maximum* (Kendall 1976), *Paspalum ciliatifolium* (Scott 1986), *Sorghum halepense* (Kendall 1976).

Specimens Examined. EGGS: MEXICO: SAN LUIS POTOSI: Lot 987, 10 eggs (ROK). LARVAE: MEXICO: SAN LUIS POTOSI: Lot 987, 16 larvae (instars 3, 4, 5) (ROK). PUPAE: MEXICO: SAN LUIS POTOSI: Lot 987, 13 pupae (ROK).

28. *Urbanus tanna* Evans

Nothing is known of the biology of this neotropical species.

29. *Urbanus simplicius* (Stoll)

No immature specimens of this tropical species were located for study. Moss (1949) briefly described the larva.

Host Plants. CANNACEAE: *Canna* species (da Costa Lima 1936) [erroneous]. FABACEAE: *Phaseolus vulgaris* (Garth and Tilden 1986), *Schranksia* species (Moss 1949).

30. *Urbanus procne* (Plötz)

Diagnosis. EGG: height 0.9-1mm, width 0.7-0.8mm, 13-15 ribs. LAST INSTAR LARVA: BODY: length 24.5-36mm, A4 transverse width 4.3-6.3mm; preserved specimens brownish; some setae with expanded tips, to 0.3mm long on A4 dorsum; spiracles dark brown. HEAD: dark reddish brown; transverse width 4.3-4.8mm; sculpturing pebbly, small spines at apex; mandibles without teeth; setae simple, to 0.4mm long at apex, ventral setae to 0.4mm; stennmata subequal (Figure 38F); postocciput wide. THORAX: legs brown; shield broad, tan. ABDOMEN: prolegs each with about 80 crochets, irregularly triordinal, arranged in a near circle. PUPA: Figures 63D and 83B, length 21.5-22mm, A3 transverse width 7.6-7.8mm; brown with darker markings; thoracic spiracle guard distinct; posterior margin of prothorax crenulated; setae simple, < 0.1mm long on head; head rounded; antennae extend slightly caudad of tip of middle leg; proboscis extending to the wing tips; abdomen short; cremaster to 1.9mm long, blunt with numerous hooked setae in a cluster at the tip (Figures 102E and 113H).

Host Plants. POACEAE: *Cynodon dactylon* (Kendall 1966a), *Lolium perenne* (Kendall 1976, in lab), *Panicum maximum* (Kendall 1976, in lab), *Sorghum halepense* (Scott 1986), *Stenotaphrum secundatum* (Kendall 1976, in lab).

Specimens Examined. EGGS: TEXAS: CAMERON CO.: Lot 986, 10 eggs (ROK). LARVAE: COLOMBIA: DEPT. VALLE DEL CAUCA:

Lot 518, 1 larva (instar 5) (MCM). TEXAS: CAMERON CO.:

Lot 986, 5 larvae (instars 4, 5) (ROK). PUPAE: TEXAS:

CAMERON CO.: Lot 986, 4 pupae (ROK).

31. *Urbanus doryssus* (Swainson)

Nothing is known of the biology of this neotropical species.

32. *Urbanus albimargo* (Mabille)

Nothing is known of the biology of this neotropical species.

33. *Astraptes fulgerator* (Reakirt)

Diagnosis. EGG: height 1.2-1.4mm, width 0.9-1.2mm, 15-17 ribs. LAST INSTAR LARVA: BODY: length 29-49mm, A4 transverse width 5.1-8.3mm; preserved specimens brownish red with transverse yellow stripes on T2-A9, ventral side bright red; setae simple, to 1.6mm long on A4 dorsum; spiracles tan. HEAD: Figure 23F, light brown with darker brown patches on upper face; transverse width 5.3-6.2mm; sculpturing pebbly; mandibles without teeth; setae simple, to 2mm long at apex, ventral setae to 2mm; stemmata subequal (Figure 38G); postocciput wide. THORAX: legs red basally, tan distally; shield broad, brown. ABDOMEN: prolegs each with about 150 crochets, irregularly triordinal, arranged in a circle; suranal plate rounded, unmarked (Figure 46F).

PUPA: Figures 63E and 84A, length 22-28.5mm, A3 transverse width 7.7-10.3mm; brown to dark brown; thoracic spiracle guard distinct; posterior margin of prothorax crenulated;

setae simple, to 0.3mm long on head; head rounded, a short point on the anterior margin of eyes; antennae extend slightly caudad of tip of middle leg; proboscis extending to the wing tips; abdomen short; cremaster to 2.4mm long, blunt with numerous hooked setae in a cluster at the tip (Figures 102F and 113I).

Other Descriptions. Moss 1949 (larva, pupa), Comstock and Vazquez 1960 (larva, pupa), Young 1985 (egg, larva).

Host Plants. AQUIFOLIACEAE: *Ilex paraguariensis* (Hayward 1941). ASTERACEAE: *Calea urticifolia* (Young 1985).

FABACEAE: *Cassia hoffmanseggii* (Moss 1949), *Cassia* species (da Costa Lima 1936), *Erythrina* species (Young 1985), *Inga* species (Moss 1949). RHAMNACEAE: *Karwinskia humboldtiana* (Kendall and McGuire 1975). TRIGONIACEAE: *Trigonia rugosa* (Young 1985). VERBENACEAE: *Vitex mollis* (Comstock and Vazquez 1960).

Specimens Examined. EGGS: MEXICO: TAMAULIPAS: Lot 910, 4 eggs (ROK). USA: TEXAS: HIDALGO CO.: Lot 911, 3 eggs (ROK). LARVAE: MEXICO: TAMAULIPAS: Lot 910, 3 larvae (instars 3, 5) (ROK). TEXAS: HIDALGO CO.: Lot 909, 1 larva (instar 5) (ROK); Lot 911, 1 larva (instar 5) (ROK). PUPAE: USA: TEXAS: HIDALGO CO.: Lot 909, 1 pupa (ROK); Lot 910, 3 pupae (ROK).

34. *Astraptes egregius* (Butler)

Nothing is known of the biology of this neotropical species.

35. *Astraptes alardus* (Stoll)

Moss (1949) briefly described the larva and pupa of this neotropical species, but I could not find specimens of the immature stages for study. This skipper has rarely been recorded from the U. S.

36. *Astraptes gilberti* H. A. Freeman

Diagnosis. LAST INSTAR LARVA: BODY: length 18.5-32mm, A4 transverse width 3.7-6.6mm; preserved specimens red with numerous tiny yellow spots, the sides yellow, a rectangular orange spot above the spiracle of A8; setae simple, to 2mm long on A4 dorsum; spiracles tan. HEAD: Figure 24A, light brown with darker around the mouth, large yellow eye patches present; transverse width 4.6-5.6mm; sculpturing pebbly; mandibles without teeth; setae simple, to 0.3mm long at apex, a few ventral setae to 0.8mm; stemmata subequal (Figure 38H); postocciput wide. THORAX: legs red basally, tan distally; shield broad, tan. ABDOMEN: prolegs each with about 140 crochets, irregularly triordinal, arranged in a circle. PUPA: Figures 64A and 84B, length 18mm, A3 transverse width 6.2mm; brown; thoracic spiracle guard distinct; posterior margin of prothorax crenulated; setae simple, < 0.1mm long on head; head rounded; antennae extend slightly caudad of tip of middle leg; proboscis extending to the wing tips; abdomen short; cremaster to 1.6mm long, blunt with numerous hooked setae in a cluster at the tip (Figures 102G and 114A).

Host Plants. FABACEAE: *Bauhinia divaricata* (Kendall and McGuire 1975).

Specimens Examined. LARVAE: MEXICO: SAN LUIS POTOSI: Lot 912, 18 larvae (instars 2, 3, 4, 5) (ROK). PUPAE: MEXICO: SAN LUIS POTOSI: Lot 912, 4 pupae (ROK).

37. *Astraptes galesus* (Mabille)

Nothing is known of the biology of this neotropical species.

38. *Astraptes anaphus* (Cramer)

Diagnosis. LAST INSTAR LARVA: BODY: length 24mm, A4 transverse width 5.5mm; preserved specimen brownish; setae simple, to 0.1mm long on A4 dorsum; spiracles tan. HEAD: reddish brown, large yellow eye patches present; transverse width 5mm; sculpturing pebbly, small spines at apex; mandibles without teeth; setae simple, to 0.3mm long at apex, a few ventral setae to 0.7mm; stemmata subequal (Figure 38I); postocciput wide. THORAX: legs tan; shield broad, dark brown. ABDOMEN: prolegs each with about 100 crochets, irregularly triordinal, arranged in a circle.

Host Plants. FABACEAE: (Moss 1949), *Phaseolus* species (Pyle 1981), *Pueraria lobata* (Kendall 1976).

Specimens Examined. LARVAE: COLOMBIA: VALLE DEL CAUCA PROV.: Lot 83, 1 larva (instar 5) (MCM).

39. *Autochton cellus* (Boisduval and Leconte)

Diagnosis. LAST INSTAR LARVA: BODY: Figure 19A, length 17.5-30.5mm, A4 transverse width 4.2-7.1mm; green with

numerous tiny yellow spots, subdorsal line wide, lemon yellow, ventral prothorax bright red; some setae with slightly expanded tips, < 0.1mm long on A4 dorsum; spiracles pale. HEAD: Figure 24B, brown, paler toward apex, large pale orange eye patches present; transverse width 4.2-7.1mm; sculpturing pebbly; mandibles without teeth; setae simple, to 0.2mm long at apex, a few ventral setae to 0.7mm; stemmata subequal (Figure 38J); postocciput wide. THORAX: T1 legs dark brown, T2-3 legs pale; shield broad, dark brown. ABDOMEN: prolegs each with about 100 crochets, irregularly triordinal, arranged in a circle; suranal plate rounded, unmarked (Figure 47A). PUPA: Figures 64B and 84C, length 16-21mm, A3 transverse width 5.3-7.7mm; brown; thoracic spiracle guard distinct; posterior margin of prothorax crenulated; setae simple, to 0.5mm long on head; head rounded; antennae extend slightly caudad of tip of middle leg; proboscis extending to the wing tips; abdomen short; cremaster to 1.6mm long, blunt with numerous hooked setae in a cluster at the tip (Figures 102H and 114B).

Other Descriptions. Beutenmüller 1893 (larva, pupa), Clark 1934, 1936 (egg, larva, pupa).

Host Plants. CONVOLVULACEAE: *Bonamia aquatica* (Scudder 1889a) [erroneous]. FABACEAE: *Amphicarpa bracteata* (Clark 1934), *Clitoria mariana* (Burns 1984, probably; Scott 1986), *Desmodium batocaulon* (Bailowitz and Brock 1991, possibly), *Phaseolus grayanus* (Burns 1984), *Phaseolus ritensis*

(Bailowitz and Brock 1991, possibly), *Phaseolus wrightii* (Burns 1984), *Pueraria lobata* (MCM collection), *Robinia neomexicana* (Bailowitz and Brock 1991), *Vigna* species (Burns 1984). SAXIFRAGACEAE: *Hydrangea* species (Clark 1936) [erroneous].

Specimens Examined. LARVAE: FLORIDA: ALACHUA CO.: Lot 48, 1 larva (instar 3) (MCM); Lot 49, 3 larvae (instars 3, 5) (MCM); Lot 50, 4 larvae (instar 5) (MCM); Lot 51, 10 larvae (instars 3, 4, 5). TEXAS: BRESTER CO.: Lot 914, 6 larvae (instar 5) (ROK). PUPAE: FLORIDA: ALACHUA CO.: Lot 50, 1 pupa (MCM). TEXAS: BREWSTER CO.: Lot 914, 2 pupae (ROK).

40. *Autochton pseudocellus* (Coolidge and Clemence) No immature specimens of this tropical species were located for study. This skipper is rarely found in the U. S.

Host Plants. FABACEAE: *Desmodium batocaulon* (Bailowitz and Brock 1991).

41. *Achalarus lyciades* (Geyer)

Diagnosis. EGG: height 1.1mm, width 0.9-1mm, 14-16 ribs. LAST INSTAR LARVA: BODY: length 15-29mm, A4 transverse width 4-6.7mm; brown with small scattered patches of black microspines; some setae with expanded tips, to 0.2mm long on A4 dorsum; spiracles dark brown. HEAD: Figure 24C, black; transverse width 4.5-5.4mm; sculpturing pebbly, small spines at apex; mandibles without teeth; setae simple, to 0.3mm

long at apex, a few ventral setae to 0.6mm; stemmata subequal (Figure 38K); postocciput wide. THORAX: T1 legs dark brown, T2-3 legs pale; shield broad, dark brown. ABDOMEN: prolegs each with about 85 crochets, irregularly triordinal, arranged in a circle; suranal plate rounded, unmarked (Figure 47B). PUPA: Figure 64C, length 17.5mm, A3 transverse width 5.3mm; brown; thoracic spiracle guard distinct; posterior margin of prothorax crenulated; setae simple, to 0.2mm long on head; head rounded; antennae extend slightly caudad of tip of middle leg; proboscis extending to the wing tips; abdomen short; cremaster to 1.8mm long, blunt with numerous hooked setae in a cluster at the tip (Figures 102I and 114C).

Other Descriptions. Scudder 1889a (egg, larva, pupa)

Host Plants. CONVOLVULACEAE: *Ipomoea pandurata* (Scudder 1889a,b) [erroneous], *Ipomoea* species (Davenport and Dethier 1938) [erroneous]. FABACEAE: *Amorpha fruticosa* (Tietz 1972), *Baptisia* species (Scudder 1889a,b), *Clitoria mariana* (MCM collection), *Desmodium canadense* (Shapiro 1974a), *Desmodium ciliare* (Kendall 1965), *Desmodium cuspidatum* (Shapiro 1974a), *Desmodium glabellum* (Tietz 1972), *Desmodium "dillenii"* (Scudder 1889a,b) [this name is currently placed under both *D. glabellum* and *D. perplexum*], *Desmodium nudiflorum* (Shapiro 1974a), *Desmodium nuttallii* (Shapiro 1974a), *Desmodium paniculatum* (Scudder 1889a,b), *Desmodium rotundifolium* (Shapiro 1974a), *Hedysarum* species (Scudder

1869), *Indigofera caroliniana* (Tietz 1952), *Indigofera* species (Scudder 1889a,b), *Lespedeza hirta* (Tietz 1952), *Lespedeza texana* (Kendall 1965). FUMARIACEAE: *Corydalis sempervirens* (Scudder 1889a,b, possibly; Tietz 1952) [erroneous].

Specimens Examined. EGGS: TEXAS: WALKER CO.: Lot 896, 10 eggs (ROK). LARVAE: FLORIDA: ALACHUA CO.: Lot 45, 1 larva (instar 5) (MCM). GEORGIA: HARRIS CO.: Lot 47, 2 larvae (instars 2,4) (MCM). NORTH CAROLINA: IREDELL CO.: Lot 46, 1 larva (instar 5) (MCM). TEXAS: WALKER CO.: Lot 896, 21 larvae (instars 1,2,4,5) (ROK). PUPAE: TEXAS: WALKER CO.: Lot 896, 1 pupa (ROK).

42. *Achalarus casica* (Herrich-Schäffer)

Diagnosis. LAST INSTAR LARVA: BODY: length 16-31mm, A4 transverse width 4.7-7.2mm; preserved specimens brownish with small scattered patches of black microspines; some setae with expanded tips, to 0.2mm long on A4 dorsum; spiracles dark brown. HEAD: dark reddish brown; transverse width 5-5.4mm; sculpturing pebbly, small spines at apex; mandibles without teeth; setae simple, to 0.2mm long at apex, a few ventral setae to 0.7mm; stemmata subequal (Figure 38L); postocciput wide. THORAX: T1 legs dark brown, T2-3 legs pale; shield broad, dark brown. ABDOMEN: prolegs irregularly triordinal, arranged in a circle.

Host Plants. FABACEAE: *Clitoria mariana* (Bailowitz and Brock 1991), *Desmodium batocaulon* (Bailowitz and Brock

1991), *Desmodium cinerascens* (Bailowitz and Brock 1991), *Desmodium grahamii* (ROK collection).

Specimens Examined. LARVAE: TEXAS: JEFF DAVIS CO.: Lot 895, 6 larvae (instars 4,5) (ROK).

43. *Achalarus albociliatus* (Mabille)

Nothing is known of the biology of this neotropical species.

44. *Achalarus toxeus* (Plötz)

No immature specimens of this neotropical species were located for study.

Host Plants. FABACEAE: *Acacia farnesiana* (Kendall 1965, possibly), *Pithecellobium flexicaule* (Kendall 1965), *Prosopis glandulosa* (Kendall 1965, possibly).

45. *Achalarus jalapus* (Plötz)

Nothing is known of the biology of this neotropical species.

46. *Thorybes bathyllus* (J. E. Smith)

Diagnosis. LAST INSTAR LARVA: BODY: length 20.5-37mm, A4 transverse width 3.6-7mm; color variable, green or brown, heart line dark, subdorsal line narrow, pale yellow or pinkish; some setae with expanded tips, to 0.2mm long on A4 dorsum; spiracles dark brown. HEAD: Figure 24D, black; transverse width 4.3-5.5mm; sculpturing pebbly; mandibles without teeth; setae simple, to 0.2mm long at apex, a few ventral setae to 0.8mm; stemmata subequal (Figure 39A); postocciput wide. THORAX: legs dark brown; shield broad,

dark brown. ABDOMEN: prolegs each with about 75 crochets, irregularly triordinal, arranged in a circle or near circle; suranal plate rounded, unmarked (Figure 47C). PUPA: Figures 58B, 64D and 85A, length 19.5-20.5mm, A3 transverse width 6.2-6.8mm; pale green or cream-colored with brown spots and markings; thoracic spiracle guard distinct; posterior margin of prothorax crenulated; setae simple, to 0.3mm long on head; head rounded; antennae extend slightly caudad of tip of middle leg; proboscis extending to the wing tips; abdomen short; cremaster to 1.6mm long, blunt with numerous hooked setae in a cluster at the tip (Figures 103A and 114D).

Other Descriptions. Harris 1862 (pupa), Scudder 1889a (egg, larva, pupa).

Host Plants. FABACEAE: *Apios americana* (Beutenmüller 1893), *Astragalus engelmannii* (Kendall 1965), *Centrosema virginianum* (Scudder 1889a,b), *Clitoria mariana* (MCM collection), *Desmodium ciliare* (Kendall 1965), *Desmodium "dillenii"* (Middleton 1881) [this name is currently placed under both *D. glabellum* and *D. perplexum*], *Desmodium paniculatum* (Kendall 1965), *Desmodium rotundifolium* (Shapiro 1968), *Desmodium strictum* (MCM collection), *Desmodium viridiflorum* (MCM collection), *Glycine reticulata* (Harris 1972), *Glycine* species (Harris 1862), *Hedysarum* species (Harris 1862), *Lespedeza capitata* (Grossbeck 1917), *Lespedeza hirta* (Scudder 1889a,b, probably; Tietz 1952),

Lespedeza texana (Kendall 1965, in lab), *Lespedeza virginica* (Tietz 1952), *Rhynchosia tomentosa* (Scudder 1889a,b), *Strophostyles helveola* (Huber 1966), *Strophostyles leiosperma* (Huber 1966), *Strophostyles* species (Klots 1951), *Tephrosia florida* (Scudder 1889a,b), *Tephrosia virginiana* (Harris 1972), *Trifolium pratense* (Tietz 1972).

Specimens Examined. LARVAE: FLORIDA: ALACHUA CO.: Lot 475, 1 larva (instar 5) (MCM); Lot 478, 1 larva (instar 5) (MCM); Lot 1277, 1 larva (instar 5) (DHH); Lot 1279, 1 larva (instar 5) (DHH); Lot 1280, 1 larva (instar 5) (DHH). LEON CO.: Lot 1278, 1 larva (instar 5) (DHH). MARION CO.: Lot 742, 1 larva (instar 5) (MCM). PUTNAM CO.: Lot 473, 1 larva (instar 5) (MCM); Lot 474, 5 larvae (instars 3, 4, 5) (MCM); Lot 476, 4 larvae (instars 3, 5) (MCM); Lot 481, 1 larva (instar 5) (MCM); Lot 740, 2 larvae (instar 3) (MCM); Lot 741, 1 larva (instar 5) (MCM); Lot 744, 2 larvae (instar 5) (MCM); Lot 745, 1 larva (instar 5) (MCM); Lot 746, 1 larva (instar 5) (MCM); Lot 747, 1 larva (instar 5) (MCM). INDIANA: TIPPECANOE CO.: Lot 477, 1 larva (instar 5) (MCM). PUPAE: FLORIDA: PUTNAM CO.: Lot 743, 2 pupae (MCM); Lot 749, 1 pupa (MCM).

47. *Thorybes pylades* (Scudder)

Diagnosis. EGG: Figure 3C, height 0.6-0.9mm, width 0.8-1.1mm, ribs 12-17, white. LAST INSTAR LARVA: BODY: Figure 19C, length 18-41mm, A4 transverse width 4.2-6.9mm; color variable, green or pinkish brown, heart line dark, subdorsal

line narrow, pale yellow or pinkish, ventral prothorax reddish; some setae with expanded tips, to 0.2mm long on A4 dorsum; spiracles dark brown. HEAD: black; transverse width 4.3-5.5mm; sculpturing pebbly; mandibles without teeth; setae simple, to 0.1mm long at apex, a few ventral setae to 0.4mm; stemmata subequal (Figure 39B); postocciput wide. THORAX: T1 legs dark brown, T2-3 legs pale; shield broad, dark brown. ABDOMEN: prolegs each with about 90 crochets, irregularly triordinal, arranged in a near circle. PUPA: Figures 64E and 85B, length 20-28mm, A3 transverse width 6.2-7.2mm; pale green or cream-colored with brown spots and markings; thoracic spiracle guard distinct; posterior margin of prothorax crenulated; setae simple, to 0.2mm long on head; head rounded; antennae extend slightly caudad of tip of middle leg; proboscis extending to the wing tips; abdomen short; cremaster to 1.6mm long, blunt with numerous hooked setae in a cluster at the tip (Figures 103B and 114E).

Other Descriptions. Scudder 1881 (egg), Scudder 1889a (egg, larva, pupa), Comstock and Dammers 1933b (egg, larva, pupa), Emmel and Emmel 1973 (egg, larva, pupa).

Host Plants. FABACEAE: *Amorpha californica* (Comstock and Dammers 1933b), *Apis americana* (MCM collection), *Astragalus nuttallianus* (Kendall 1965), *Centrosema floridanum* (MCM collection), *Centrosema virginianum* (MCM collection), *Cologania angustifolia* (Bailowitz and Brock 1991), *Desmodium*

batocaulon (Bailowitz and Brock 1991), *Desmodium canadense* (Shapiro 1974a), *Desmodium glabellum* (Tietz 1972), *Desmodium "dillenii"* (Scudder 1889a,b) [this name is currently placed under both *D. glabellum* and *D. perplexum*], *Desmodium nudiflorum* (Tietz 1952), *Desmodium paniculatum* (Kendall 1965), *Desmodium rotundifolium* (Shapiro 1974a), *Galactia elliottii* (MCM collection), *Galactia regularis* (Minno 1992), *Hedysarum* species (Edwards 1870, in lab), *Lathyrus eucosmus* (Scott 1986), *Lathyrus jepsonii* ssp. *californicus* (Shapiro et al. 1981, associated with), *Lathyrus ochroleucus* (Scott 1986), *Lespedeza capitata* (Scudder 1889a,b), *Lespedeza hirta* (Scudder 1889a,b), *Lespedeza intermedia* (Shapiro 1974a), *Lotus crassifolius* (Scott 1986), *Lotus douglasii* (Newcomer 1964), *Medicago sativa* (Shapiro 1966), *Rhynchosia difformis* (Minno 1992), *Rhynchosia texana* (Kendall 1965), *Trifolium pratense* (Scudder 1889a,b), *Trifolium repens* (Scudder 1889a,b), *Vicia americana* (Scott 1986).

Specimens Examined. EGGS: TEXAS: JEFF DAVIS CO.: Lot 981, 3 eggs (ROK). FLORIDA: NASSAU CO.: Lot 1535, 1 egg (MCM). PUTNAM CO.: Lot 1536, 1 egg (MCM). LARVAE: CALIFORNIA: RIVERSIDE CO.: Lot 594, 1 larva (instar 5) (GRB). FLORIDA: HIGHLANDS CO.: Lot 482, 1 larva (instar 5) (MCM); Lot 485, 1 larva (instar 5) (MCM); Lot 486, 3 larvae (instar 5) (MCM); Lot 487, 2 larvae (instar 5) (MCM). LEVY CO.: Lot 484, 3 larvae (instar 5) (MCM). MARION CO.: Lot 483, 2 larvae (instar 5) (MCM). TEXAS: JEFF DAVIS CO.:

Lot 981, 6 larvae (instars 3, 5) (ROK). PUPAE: FLORIDA: HIGHLANDS CO.: Lot 487, 2 pupae (MCM). TEXAS: JEFF DAVIS CO.: Lot 981, 2 pupae (ROK).

48. *Thorybes diversus* Bell

Diagnosis. LAST INSTAR LARVA: BODY: length 31.5-32.5mm, A4 transverse width 6.7-6.8mm; preserved specimen brownish; some setae with expanded tips, to 0.2mm long on A4 dorsum; spiracles dark brown. HEAD: black; transverse width 4.4-4.5mm; sculpturing pebbly; mandibles without teeth; setae simple, to 0.2mm long at apex, a few ventral setae to 0.6mm; stemmata subequal (Figure 39C); postocciput wide. THORAX: T1-2 legs dark brown, T3 legs brown; shield broad, dark brown. ABDOMEN: prolegs each with about 55 crochets, irregularly triordinal, arranged in a circle or near circle.

Other Descriptions. MacNeill 1975 (egg, larva).

Host Plants. FABACEAE: *Trifolium wormskjoldii* (MacNeill 1975).

Specimens Examined. LARVAE: CALIFORNIA: DEL NORTE CO.: Lot 488, 1 larva (instar 5) (MCM); Lot 595; 1 larva (instar 5) (GRB).

49. *Thorybes mexicanus* (Herrich-Schäffer)

Diagnosis. LAST INSTAR LARVA: BODY: length 26mm, A4 transverse width 5.5mm; preserved specimen brownish; some setae with expanded tips, to 0.2mm long on A4 dorsum; spiracles dark brown. HEAD: black; transverse width 3.7mm; sculpturing pebbly; mandibles without teeth; setae simple,

to 0.2mm long at apex, a few ventral setae to 0.8mm; stemmata subequal (Figure 39D); postocciput wide. THORAX: T1 legs dark brown, T2-3 legs brown; shield broad, dark brown. ABDOMEN: crochets, irregularly triordinal, arranged in a circle.

Other Descriptions. Emmel et al. 1992 (larva).

Host Plants. FABACEAE: *Amorpha californica* (Comstock and Dammers 1933b) [erroneous, MacNeill 1975], *Astragalus* species (Beutelspacher 1980), *Desmodium* species (Beutelspacher 1980), *Lathyrus arizonicus* (Bailowitz and Brock 1991), *Lathyrus leucanthus* (Shields et al. 1970), *Lathyrus* species (Dornfeld 1980), *Lespedeza* species (Beutelspacher 1980), *Rhynchosia* species (Beutelspacher 1980), *Trifolium longipes* (Scott 1986), *Trifolium monanthum* (Lembert 1894), *Vicia americana* (Scott 1986). POACEAE: *Sitanion* species (Dornfeld 1980) [erroneous].

Specimens Examined. LARVAE: CALIFORNIA: INYO CO.: Lot 579, 1 larva (instar 5) (GRB).

50. *Thorybes confusis* Bell

Diagnosis. LAST INSTAR LARVA: BODY: length 18-37mm, A4 transverse width 3.6-6.3mm; pinkish brown, heart line dark, subdorsal line narrow, pale pink, ventral prothorax reddish; some setae with expanded tips, to 0.3mm long on A4 dorsum; spiracles dark brown. HEAD: black; transverse width 4.2-4.9mm; sculpturing pebbly; mandibles without teeth; setae simple, to 0.2mm long at apex, a few ventral setae to 0.3mm;

stemma subequal (Figure 39E); postocciput wide. THORAX: T1 legs dark brown, T2-3 legs pale; shield broad, dark brown. ABDOMEN: prolegs each with about 85 crochets, irregularly triordinal, arranged in a circle or near circle. PUPA: Figures 64F and 85C, length 19.5mm, A3 transverse width 5.7-6.4mm; pale green or cream-colored with brown spots and markings; thoracic spiracle guard distinct; posterior margin of prothorax crenulated; setae simple, to 0.3mm long on head; head rounded; antennae extend slightly caudad of tip of middle leg; proboscis extending to the wing tips; abdomen short; cremaster to 1.5mm long, blunt with numerous hooked setae in a cluster at the tip (Figures 103C and 114F).

Host Plants. FABACEAE: *Lespedeza* species (Shapiro 1966, possibly), *Tephrosia florida* (MCM collection), *Trifolium repens* (MCM collection, in lab).

Specimens Examined. LARVAE: FLORIDA: ALACHUA CO.: Lot 1494, 1 larva (instar 5) (DHH). PUTNAM CO.: Lot 479, 1 larva (instar 5) (MCM); Lot 748, 5 larvae (instars 3, 5) (MCM). PUPAE: FLORIDA: PUTNAM CO.: Lot 748, 2 pupae (MCM).

51. *Thorybes drusius* (Edwards)

Diagnosis. LAST INSTAR LARVA: BODY: length 20-30.5mm, A4 transverse width 4.6-5.8mm; preserved specimens pinkish brown, heart line dark, subdorsal line pink, ventral prothorax pale red; some setae with expanded tips, to 0.1mm

long on A4 dorsum; spiracles dark brown. HEAD: dark brown; transverse width 4-4.5mm; sculpturing pebbly; mandibles without teeth; setae simple, to 0.2mm long at apex, a few ventral setae to 0.4mm; stemmata subequal (Figure 39F); postocciput wide. THORAX: legs dark brown; shield broad, dark brown. ABDOMEN: prolegs each with about 50 crochets, irregularly triordinal, arranged in a circle or near circle. Host Plants. FABACEAE: *Cologania angustifolia* (Bailowitz and Brock 1991).

Specimens Examined. LARVAE: MEXICO: CHIHUAHUA: Lot 980, 10 larvae (instars 3, 5) (ROK) - probably this species.

52. *Thorybes valerianus* (Plötz)

Nothing is known of the biology of this species, except that the larvae feed on leguminous plants (Scott 1986).

53. *Cabares potrillo* (Lucas)

Diagnosis. EGG: height 0.8-0.9mm, width 0.5-0.6mm, ribs 10-11. LAST INSTAR LARVA: BODY: length 25mm, A4 transverse width 5mm; preserved specimen pale; some setae with expanded tips, to 0.1mm long on A4 dorsum; spiracles brown. HEAD: Figure 24E, dark reddish brown; transverse width 3.8mm; sculpturing pebbly, small spines at apex; mandibles without teeth; setae simple, to 0.2mm long at apex, a few ventral setae to 0.5mm; stemmata subequal (Figure 39G); postocciput wide. THORAX: legs dark brown; shield pale dorsally, brown laterally. ABDOMEN: crochets, irregularly triordinal, arranged in a circle; suranal plate

rounded, unmarked (Figure 47D). PUPA: Figures 65A and 85D, length 18.5mm, A3 transverse width 5.2mm; brown; thoracic spiracle guard distinct; posterior margin of prothorax crenulated; setae simple, to 0.3mm long on head; head rounded; antennae extend slightly caudad of tip of middle leg; proboscis extending to the wing tips; abdomen short; cremaster to 1.5mm long, tapering, blunt with numerous hooked setae in a cluster at the tip (Figures 103D and 114G).

Other Descriptions. Dethier 1940a (egg), MacNeill 1975 (egg, larva, pupa).

Host Plants. LAMIACEAE: *Salvia* species (ROK collection). VERBENACEAE: *Priva lappulacea* (Kendall and Rickard 1976).

Specimens Examined. EGGS: TEXAS: HIDALGO CO.: Lot 915, 10 eggs (ROK). LARVAE: TEXAS: HIDALGO CO.: Lot 915, 2 larvae (instars 2, 5) (ROK). PUPAE: TEXAS: HIDALGO CO.: Lot 915, 1 pupa (ROK).

54. *Celaenorrhinus fritzgaertneri* (Bailey)

Nothing is known of the biology of this neotropical species.

55. *Celaenorrhinus stallingsi* H. A. Freeman

Nothing is known of the biology of this neotropical species.

56. *Dyscophellus euribates* (Stoll)

Moss (1949) gave a description of the larva and pupa of this neotropical species, and listed the host plant as

Virola spp. (Myristicaceae). This skipper is rarely recorded from the U. S. I could not locate specimens of the immature stages for study.

57. *Spathilepia clonius* (Cramer)

No immature specimens of this tropical species were located for study. Moss (1949) briefly described the larva and pupa.

Host Plants. FABACEAE: *Inga edulis* (Moss 1949), *Phaseolus* species (Moss 1949).

58. *Cogia calchas* (Herrich-Schäffer)

No immature specimens of this neotropical species were located for study. Moss (1949) briefly described the larva.

Host Plants. FABACEAE: *Indigofera* species (Moss 1949), *Malicia* species (Brown and Heineman 1972), *Mimosa pigra* var. *berlandieri* (Kendall 1966a), *Schranksia* species (Moss 1949).

59. *Cogia hippalus* (Edwards)

Diagnosis. LAST INSTAR LARVA: BODY: length 16.5-22mm, A4 transverse width 3.6-5mm; preserved specimen pale with numerous tiny yellow spots; some setae with expanded tips, < 0.1mm long on A4 dorsum; spiracles tan. HEAD: Figure 24F, light brown, front dark brown, posterior black, yellowish eye patches present; transverse width 4-4.3mm; sculpturing pebbly; mandibles without teeth; setae branching, < 0.1mm long at apex, a few ventral setae to 0.4mm; stemmata subequal (Figure 39H); postoccipt wide. THORAX: legs pale; shield indistinct. ABDOMEN: Prolegs each with about

45 crochets, irregularly triordinal, arranged in a mesal penellipse; suranal plate rounded, unmarked (Figure 47E).
PUPAL EXUVIUM: cremaster blunt with numerous hooked setae at tip (Figures 103E and 114H).

Host Plants. FABACEAE: *Acacia angustissima* (Pyle 1981).

Specimens Examined. LARVAE: MEXICO: TAMAULIPAS: Lot 928, 3 larvae (instar 5) (ROK).

60. *Cogia outis* (Skinner)

Diagnosis. EGG: height 0.6-0.7mm, width 0.5-0.6mm, polygonal sculpturing, no ribs. LAST INSTAR LARVA: BODY: length 13.5-24mm, A4 transverse width 3.8-5.8mm; preserved specimens pale; some setae with expanded tips, < 0.1mm long on A4 dorsum; spiracles tan. HEAD: light brown, posterior black, faint yellowish eye patches present; transverse width 3.7-4.3mm; sculpturing pebbly; mandibles without teeth; setae branching, < 0.1mm long at apex, a few ventral setae to 0.4mm; stemmata subequal (Figure 39I); postocciput wide. THORAX: legs tan to pale; shield indistinct. ABDOMEN: prolegs each with about 45 crochets, irregularly triordinal, arranged in a near circle or mesal penellipse. PUPA: Figures 65B and 85E, length 15-19mm, A3 transverse width 4.8-6mm; light brown with darker spots and markings; thoracic spiracle guard distinct; setae simple, < 0.1mm long on head; head rounded; antennae extend slightly caudad of tip of middle leg; proboscis extending to the wing tips; abdomen short; cremaster to 1.7mm long, tapering, blunt with

numerous hooked setae in a cluster at the tip (Figures 103F and 114I).

Host Plants. FABACEAE: *Acacia angustissima* var. *hirta* (Kendall 1965), *Acacia texensis* (Kendall 1965).

Specimens Examined. EGGS: TEXAS: BEXAR CO.: Lot 930, 4 eggs (ROK). LARVAE: TEXAS: BEXAR CO.: Lot 930, 10 larvae (instars 2, 3, 5) (ROK). PUPAE: TEXAS: BEXAR CO.: Lot 930, 14 pupae (ROK).

61. *Cogia caicus* (Herrich-Schäffer)

Diagnosis. LAST INSTAR LARVA: BODY: length 20-37.5mm, A4 transverse width 4.1-7.3mm; preserved specimens pale with numerous tiny yellow spots; some setae with expanded tips, < 0.1mm long on A4 dorsum; spiracles tan. HEAD: light brown, front darker brown, posterior black, yellow eye patches present; transverse width 3.7-4.7mm; sculpturing pebbly; mandibles without teeth; setae branching, < 0.1mm long at apex, a few ventral setae to 0.4mm; stemmata subequal (Figure 39J); postocciput wide. THORAX: legs tan to pale; shield indistinct. ABDOMEN: prolegs each with about 30 crochets, irregularly triordinal, arranged in a mesal penellipse. PUPAL EXUVIUM: cremaster blunt with numerous hooked setae at tip (Figures 103G and 115A).

Host Plants. FABACEAE: *Acacia angustissima* (Kendall and McGuire 1975).

Specimens Examined. LARVAE: MEXICO: TAMAULIPAS: Lot 929, 1 larva (instar 5) (ROK). ARIZONA: Lot 553, 3 larvae (instar 5) (NM).

62. *Nisoniades rubescens* (Möschler)

Diagnosis. LAST INSTAR LARVA: BODY: length 16-24mm, A4 transverse width 3.6-5.3mm; preserved specimens pale, subdorsal yellow spots on T2-3; some setae with expanded tips, to 0.2mm long on A4 dorsum; spiracles tan. HEAD: Figure 25A, dark reddish brown; transverse width 3.5-3.6mm; sculpturing pebbly, small spines at apex; mandibles with teeth; setae simple, to 0.2mm long at apex, a few ventral setae to 0.6mm; stemmata subequal (Figure 39K); postocciput moderately wide. THORAX: legs tan to pale; shield broad, dark brown. ABDOMEN: prolegs each with about 110 crochets, irregularly triordinal, arranged in a near circle; suranal plate rounded, unmarked (Figure 47F). PUPAL EXUVIUM: cremaster blunt with numerous hooked setae at tip (Figures 103H and 115B).

Host Plants. CONVOLVULACEAE: *Ipomoea batatas* (Kendall 1976), *Ipomoea luteum* (Kendall 1976), *Ipomoea pandurata* (ROK collection, probably), *Ipomoea trichocarpa* (Kendall 1976, possibly).

Specimens Examined. LARVAE: MEXICO: TAMAULIPAS: Lot 955, 1 larva (instar 5) (ROK); Lot 956, 2 larvae (instar 5) (ROK).

63. *Pellicia angra* Evans

Nothing is known of the biology of this neotropical species.

64. *Pellicia arina* Evans

Nothing is known of the biology of this species from tropical America.

65. *Bolla clytius* (Godman and Salvin)

Nothing is known of the biology of this neotropical species.

66. *Bolla brennus* (Godman and Salvin)

Nothing is known of the biology of this species from tropical America.

67. *Staphylus ceos* (Edwards)

Diagnosis. LAST INSTAR LARVA: BODY: length 19.5mm, A4 transverse width 3.9mm; preserved specimen pale; some setae with blunt tips, to 0.2mm long on A4 dorsum; spiracles pale. HEAD: Figure 25B, dark reddish brown; transverse width 2.6mm; sculpturing rough; mandibles with teeth; setae feathery, to 0.5mm long at apex, ventral setae to 0.5mm; stemmata subequal; postocciput wide. THORAX: legs pale; shield indistinct. ABDOMEN: prolegs each with about 55 crochets, irregularly triordinal, arranged in a mesal penellipse; suranal plate rounded, unmarked (Figure 47G). PUPA: Figures 65C and 86A, length 12.5mm, A3 transverse width 3.8mm; light brown; thoracic spiracle guard distinct; setae simple, to 0.3mm long on head; head rounded; antennae

extend to nearly the tip of middle leg; proboscis extending to the wing tips; abdomen short; cremaster to 1mm long, constricted, blunt with numerous hooked setae in a cluster at the tip (Figures 103I and 115C).

Host Plants. CHENOPODIACEAE: *Chenopodium fremontii* (Bailowitz and Brock 1991), *Chenopodium* species (Bailowitz and Brock 1991).

Specimens Examined. LARVAE: ARIZONA: COCHISE CO.: Lot 1010, 1 larva (instar 5) (SDNHM). PUPAE: ARIZONA COCHISE CO.: Lot 1010, 1 pupa (SDNHM).

68. *Staphylus mazans* (Reakirt)

Diagnosis. LAST INSTAR LARVA: BODY: length 14-16mm, A4 transverse width 3.3mm; preserved specimen pale; some setae with expanded tips, < 0.1mm long on A4 dorsum; spiracles tan. HEAD: dark reddish brown; transverse width 3.3mm; sculpturing rough; mandibles with teeth; setae feathery, to 0.4mm long at apex, ventral setae to 0.4mm; stemmata subequal (Figure 39L); postocciput wide. THORAX: legs pale; shield broad, tan. ABDOMEN: prolegs each with about 90 crochets, irregularly triordinal, arranged in a near circle. PUPAL EXUVIUM: cremaster blunt with numerous hooked setae at tip (Figures 104A and 115D).

Host Plants. AMARANTHACEAE: *Amaranthus aspera* (Scott 1986), *Amaranthus retroflexus* (Kendall 1965).

CHENOPODIACEAE: *Chenopodium album* (Kendall 1965), *Chenopodium ambrosioides* (Kendall 1965).

Specimens Examined. LARVAE: TEXAS: HIDALGO CO.: Lot 975, 2 larvae (instar 5) (ROK).

69. *Staphylus hayhurstii* (Edwards)

Diagnosis. LAST INSTAR LARVA: BODY: Figure 20D, length 15.5-26mm, A4 transverse width 2.8-4.3mm; dark green with numerous tiny white spots; some setae with expanded tips, < 0.1mm long on A4 dorsum; spiracles pale. HEAD: black; transverse width 2.7-3mm; sculpturing rough; mandibles with teeth; setae feathery, to 0.3mm long at apex, a few ventral setae to 0.4mm; stemmata subequal (Figure 39M); postocciput wide. THORAX: legs pale; shield broad, tan. ABDOMEN: prolegs each with about 95 crochets, irregularly triordinal, arranged in a circle. PUPA: Figures 65D and 85B, length 13.5-16mm, A3 transverse width 3.8-4.3mm; brown; thoracic spiracle guard distinct; setae simple, to 0.6mm long on head; head rounded; antennal tip lies slightly cephalad of tip of middle leg; proboscis extending to the wing tips; abdomen short; cremaster to 1mm long, constricted, blunt with numerous hooked setae in a cluster at the tip (Figures 104B and 115E).

Other Descriptions. Dyar 1891 (larva, pupa), Heitzman 1963 (egg, larva, pupa), Minno and Emmel 1993 (larva, pupa).

Host Plants. AMARANTHACEAE: *Alternanthera* species (Grossbeck 1917) [erroneous], *Amaranthus* species (Forbes 1906), *Celosia nitida* (ROK collection), *Iresine diffusa* (MCM

collection), *Iresine flavesrens* (Dyar 1891).

CHENOPODIACEAE: *Chenopodium album* (Opler and Krizek 1984).

Specimens Examined. LARVAE: FLORIDA: ALACHUA CO.: Lot 467, 3 larvae (instar 5) (MCM); Lot 468, 3 larvae (instar 5) (MCM); Lot 469, 1 larva (instar 5) (MCM); Lot 738, 3 larvae (instar 5) (MCM); Lot 739, 4 larvae (instar 5) (MCM); Lot 1281, 1 larva (instar 5) (DHH). PUPAE: FLORIDA: ALACHUA CO.: Lot 467, 1 pupa (MCM); Lot 468, 1 pupa (MCM); Lot 739, 2 pupae (MCM).

70. *Gorgythion begga* (Kirby)

Nothing is known of the biology of this species from tropical America.

71. *Sostrata bifasciata* (Ménétriés)

Nothing is known of the biology of this neotropical species.

72. *Carrhenes canescens* (R. Felder)

Diagnosis. LAST INSTAR LARVA: BODY: length 18-27mm, A4 transverse width 4-4.6mm; preserved specimens pale; some setae with blunt tips, to 0.3mm long on A4 dorsum; spiracles pale. HEAD: Figure 25C, dark reddish brown; transverse width 3.4-3.7mm; sculpturing rough; mandibles without teeth; setae simple, to 0.4mm long at apex, a few ventral setae to 0.6mm; stemmata subequal (Figure 39N); postocciput wide. THORAX: legs pale; shield indistinct. ABDOMEN: prolegs each with about 80 crochets, irregularly triordinal, arranged in a circle; suranal plate rounded, unmarked

(Figure 47H). PUPA: Figures 65E and 86C, length 14mm, A3 transverse width 4.7mm; light brown; thoracic spiracle guard distinct; setae simple, to 0.8mm long on head; head rounded; antennae extend slightly caudad of tip of middle leg; proboscis extending to the wing tips; abdomen short; cremaster to 1.5mm long, blunt with numerous hooked setae in a cluster at the tip (Figures 104C and 115F).

Host Plants. MALVACEAE: *Hibiscus* species (Scott 1986), *Malache rosae* (ROK collection).

Specimens Examined. LARVAE: MEXICO: SAN LUIS POTOSI: Lot 916, 9 larvae (instars 2, 3, 5) (ROK). PUPAE: MEXICO: SAN LUIS POTOSI: Lot 916, 2 pupae (ROK).

73. *Xenophanes trixus* (R. Felder)

Diagnosis. LAST INSTAR LARVA: BODY: length 29mm, A4 transverse width 4.8mm; preserved specimens pale with numerous tiny white spots; some setae with slightly expanded tips, to 0.5mm long on A4 dorsum; spiracles pale. HEAD: Figure 25D, brown; transverse width 3.7mm; sculpturing rough; mandibles without teeth; some setae with expanded tips, to 0.3mm long at apex, a few ventral setae to 0.6mm; stemma 5 slightly small (Figure 390); postocciput wide. THORAX: legs pale; shield indistinct. ABDOMEN: prolegs each with about 90 crochets, irregularly triordinal, arranged in a circle or near circle; suranal plate rounded, unmarked (Figure 47I). PUPAL EXUVIUM: cremaster blunt with numerous hooked setae at tip (Figures 104D and 115G).

Other Descriptions. Moss 1949 (larva, pupa).

Host Plants. MALVACEAE: *Malachra fasciata* (Moss 1949),

Malvaviscus drummondii (Kendall and Rickard 1976).

Specimens Examined. LARVAE: TEXAS: CAMERON CO.: Lot 991, 1 larva (instar 5) (ROK).

74. *Systasea pulverulenta* (R. Felder)

Diagnosis. EGG: height 0.9-1.1mm, width 0.5-0.8mm, 44-52 vertical rows of short spines. LAST INSTAR LARVA: BODY: length 11-29.5mm, A4 transverse width 3.2-4.7mm; preserved specimens pale; setae simple, to 0.5mm long on A4 dorsum; spiracles pale. HEAD: Figure 25E, light brown, pale eye patches present or dark brown with two paler lines parallel to vertex, light brown around the mouth; transverse width 2.7-3.4mm; sculpturing rough; mandibles with teeth; setae simple, to 0.5mm long at apex, a few ventral setae to 0.8mm; stemmata subequal (Figure 39P); postocciput moderately wide. THORAX: legs pale; shield indistinct. ABDOMEN: prolegs each with about 30 crochets, uniordinal, arranged in a mesal penellipse. PUPA: Figures 65F and 86D, length 15-17mm, A3 transverse width 4.8mm; preserved specimens pale; thoracic spiracle guard distinct; setae simple, to 1mm long on head; head rounded; antennal tip lies slightly cephalad of tip of middle leg; proboscis extending into A5; abdomen moderately long; cremaster to 1.2mm long, constricted, blunt with numerous hooked setae in a cluster at the tip (Figures 104E and 115H).

Host Plants. MALVACEAE: *Abutilon abutiloides* (Kendall 1965), *Abutilon incanum* (Kendall 1965), *Abutilon pedunculare* (Hayward 1947), *Abutilon sonorae* (Bailowitz and Brock 1991), *Abutilon wrightii* (Kendall 1961b), *Pseudabutilon lozani* (Hayward 1947), *Sphaeralcea angustifolia* (Kendall 1965), *Wissadula amplissima* (Kendall 1965), *Wissadula holosericea* (Kendall 1960).

Specimens Examined. EGGS: TEXAS: BEXAR CO.: Lot 976, 25 eggs (ROK). LARVAE: TEXAS: BEXAR CO.: Lot 976, 8 larvae (instar 5) (ROK). COMAL CO.: Lot 1002, 6 larvae (instars 3, 4, 5) (FSCA). PUPAE: TEXAS: BEXAR CO.: Lot 976, 2 pupae (ROK).

75. *Systasea zampa* (Edwards)

Diagnosis. LAST INSTAR LARVA: BODY: length 20.5-22mm, A4 transverse width 4.3-4.4mm; preserved specimens pale; setae simple, to 0.5mm long on A4 dorsum; spiracles pale. HEAD: light brown; transverse width 2.9-3.2mm; sculpturing rough; mandibles with teeth; setae simple, to 0.4mm long at apex, a few ventral setae to 0.7mm; stemmata subequal (Figure 39Q); postocciput moderately wide. THORAX: legs pale; shield indistinct. ABDOMEN: prolegs each with about 30 crochets, uniorificial, arranged in a mesal penellipse.

Host Plants. MALVACEAE: *Abutilon abutiloides* (Bailowitz and Brock 1991), *Abutilon incanum* (Bailowitz and Brock 1991), *Abutilon parishii* (Bailowitz and Brock 1991), *Abutilon reventum* (Bailowitz and Brock 1991), *Abutilon*

sonorae (Bailowitz and Brock 1991), *Herissantia crispa* (Bailowitz and Brock 1991), *Hibiscus denudatus* (Emmel and Emmel 1973, possibly).

Specimens Examined. LARVAE: CALIFORNIA: SAN DIEGO CO.: Lot 580, 1 larva (instar 5) (GRB). TEXAS: PRESIDIO CO.: Lot 977, 1 larva (instar 5) (ROK).

76. *Achlyodes thraso* (Hübner)

Diagnosis. EGG: height 0.8-1mm, width 0.6-0.7mm, 14-16 ribs, pale yellow. LAST INSTAR LARVA: BODY: Figure 20A, length 15-32.5mm, A4 transverse width 3.5-6.8mm; green with numerous tiny yellow spots, heart line dark, subdorsal line moderately wide, bright yellow; some setae with slightly expanded tips, to 0.2mm long on A4 dorsum; spiracles tan. HEAD: Figure 25F, light brown; transverse width 3.8-5.2mm; sculpturing pebbly; mandibles with a few small teeth; setae simple, to 0.1mm long at apex, a few ventral setae to 0.7mm; stemma 1 very large, 6 large (Figure 39R); postocciput moderately wide. THORAX: legs pale; shield indistinct. ABDOMEN: prolegs each with about 190 crochets, irregularly triordinal, arranged in a circle; suranal plate rounded, unmarked (Figure 48A). PUPA: Figures 58G, 65G, and 86E, length 17-23mm, A3 transverse width 4.5-6.5mm; pale green, process on cap dark, anterior pronotum dark, pilifers with a black spot; thoracic spiracle guard a small black knob; setae simple, to 0.4mm long on head; head with a short, peg-like process on cap; antennae extend slightly caudad of tip

of middle leg; proboscis extending to the wing tips; abdomen moderately long; cremaster to 1.7mm long, blunt with numerous hooked setae in a cluster at the tip (Figures 104F and 115I).

Other Descriptions. Panton 1897 (egg, larva, pupa), Wolcott 1923 (larva, pupa), Hayward 1927b (larva, pupa), Moss 1949 (larva, pupa).

Host Plants. ROSACEAE: *Prunus occidentalis* (MCM observation). RUTACEAE: *Citrus aurantifolia* (Bruner et al. 1945), *Citrus aurantium* (Comstock 1944), *Citrus limon* (Martorell 1945), *Citrus paradisi* (Wolcott 1923), *Citrus sinensis* (Wolcott 1951), *Fagara hyemale* (Hayward 1927b), *Fagara naranjillo* (Hayward 1941), *Fagara rhoifolia* (Moss 1949), *Zanthoxylum fagara* (Kendall 1965), *Zanthoxylum martinicensis* (Bruner et al. 1945), *Zanthoxylum monophyllum* (Wolcott 1923), *Zanthoxylum pterota* (ROK collection).

Specimens Examined. EGGS: DOMINICAN REPUBLIC: PUERTO PLATA PROV.: Lot 40, 1 egg (MCM). USA: TEXAS: SAN PATRICIO CO.: Lot 898, 24 eggs (ROK). LARVAE: DOMINICAN REPUBLIC: LA VEGA PROV.: Lot 5, 2 larvae (instar 5) (MCM). PUERTO PLATA PROV.: Lot 40, 2 larvae (instars 3, 5) (MCM); Lot 41, 1 larva (instar 5) (MCM); Lot 856, 2 larvae (instar 5) (USNM); Lot 864, 2 larvae (instar 5) (USNM). JAMAICA: Lot 857, 1 larva (instar 5) (USNM). MEXICO: LEON GUANAJUATA: Lot 853, 1 larva (instar 5) (USNM). PUERTO RICO: Lot 847, 2 larvae (instar 2) (USNM); Lot 848, 1 larva

(instar 3) (USNM); Lot 852, 1 larva (instar 5) (USNM); Lot 855, 1 larva (instar 5) (USNM); Lot 858, 1 larva (instar 4) (USNM); Lot 1082, 2 larvae (instar 4) (DHH). TEXAS: SAN PATRICIO CO.: Lot 898, 32 larvae (instars 1, 3, 4, 5) (ROK). WEST INDIES: Lot 859, 2 larvae (instar 5) (USNM). PUPAE: DOMINICAN REPUBLIC: LA VEGA PROV.: Lot 5, 1 pupa (MCM). PUERTO PLATA PROV.: Lot 40, 1 pupa (MCM); Lot 41, 1 pupa (MCM). PUERTO RICO: Lot 854, 1 pupa (USNM). TEXAS: SAN PATRICIO CO.: Lot 898, 9 pupae (ROK).

77. *Grais stigmatica* (Mabille)

Nothing is known of the biology of this neotropical species.

78. *Timochares ruptifasciatus* (Plötz)

Diagnosis. LAST INSTAR LARVA: BODY: length 22.5mm, A4 transverse width 4.8mm; preserved specimens pale; setae with expanded tips, < 0.1mm long on A4 dorsum; spiracles pale. HEAD: Figure 25G, pale with a black patch at vertex and a black U-shaped mark on face, lateral line brown; transverse width 4.8mm; sculpturing rough; mandibles with teeth; setae simple, to 0.1mm long at apex, a few ventral setae to 0.4mm; stemma 5 and 6 small (Figure 40A); postocciput moderately wide. THORAX: legs pale; shield indistinct. ABDOMEN: prolegs each with about 100 crochets, irregularly triordinal, arranged in a mesal penellipse; suranal plate rounded, unmarked (Figure 48B). PUPAL EXUVIUM: cremaster

blunt with numerous hooked setae in a cluster at the tip (Figures 104G and 115J).

Other Descriptions. Comstock 1953 (egg, larva, pupa).

Host Plants. MALPIGHIACEAE: (Comstock 1953), *Malpighia glabra* (Kendall and Rickard 1976).

Specimens Examined. LARVAE: TEXAS: HIDALGO CO.: Lot 982, 1 larva (instar 5) (ROK).

79. *Chiomara asychis* (Stoll)

Diagnosis. LARVAL EXUVIUM: stemmata subequal (Figure 40B).

PUPA: Figures 65H and 86F, length 10.5mm, A3 transverse width 3.2mm; pale; thoracic spiracle guard distinct; setae simple, to 0.1mm long on head; head rounded; antennal tip lies slightly cephalad of tip of middle leg; proboscis extending to the wing tips; abdomen short; cremaster to 1mm long, blunt with numerous hooked setae in a cluster at the tip (Figures 104H and 115K).

Other Descriptions. Moss 1949 (larva, pupa).

Host Plants. MALPIGHIACEAE: (Moss 1949), *Aspicarpa hirtella* (Bailowitz and Brock 1991, possibly), *Gaudichaudia pentandra* (Kendall 1976), *Janusia gracilis* (Kendall and Rickard 1976, possibly), *Malpighia glabra* (Kendall and Rickard 1976), *Thryallis angustifolia* (Kendall and Rickard 1976, possibly).

Specimens Examined. PUPAE: TEXAS: HIDALGO CO.: Lot 923, 1 pupa (ROK).

80. *Gesta gesta* (Herrich-Schäffer)

Diagnosis. LAST INSTAR LARVA: BODY: Figure 19G, length 8-19mm, A4 transverse width 1.8-4.4mm; grayish green, heart line dark subdorsal line a chain of yellow spots on T3-A8; some setae with expanded tips, < 0.1mm long on A4 dorsum; spiracles tan. HEAD: Figure 25H, tan with six black spots on face, posterior black, area around mouth and stemmata black, occasionally mostly black; transverse width 2.6-3.2mm; sculpturing rough; mandibles without teeth, or at most a few shallow lobes; setae simple, < 0.1mm long at apex, a few ventral setae to 0.3mm; stemmata subequal (Figure 40C); postocciput moderately wide. THORAX: legs brown; shield indistinct. ABDOMEN: prolegs each with about 70 crochets, irregularly triordinal, arranged in a near circle; suranal plate rounded, unmarked (Figure 48C). PUPA: Figures 66A and 86G, length 13-15mm, A3 transverse width 3.7-4mm; pale green; thoracic spiracle guard a black knob; setae simple, to 0.2mm long on head; head rounded; antennal tip lies cephalad of tip of middle leg; proboscis extending to the wing tips; abdomen short; cremaster to 1.1mm long, blunt with numerous hooked setae in a cluster at the tip (Figures 104I and 115L).

Other Descriptions. Comstock and Vazquez 1960 (larva, pupa), Comstock and Kendall 1967 (egg, larva, pupa).

Host Plants. FABACEAE: *Cassia occidentalis* (da Costa Lima 1936), *Cassia* species (Comstock and Vazquez 1960),

Indigofera leptosepala (Kendall 1965, in lab), *Indigofera lindheimeriana* (Kendall 1965), *Indigofera suffruticosa* (Moss 1949), *Indigofera tinctoria* (Bruner et al. 1945).

Specimens Examined. LARVAE: COLOMBIA: DEPT. VALLE DEL CAUCA: Lot 241, 1 larva (instar 5) (MCM); Lot 242, 1 larva (instar 5) (MCM); Lot 243, 4 larvae (instars 4, 5) (MCM). DOMINICAN REPUBLIC: LA VEGA PROV.: Lot 240, 8 larvae (instar 5) (MCM). TEXAS: ARANSAS CO.: Lot 561, 6 larvae (instars 2, 3, 4, 5) (JRH); Lot 562, 2 larvae (instars 2, 5) (JRH). PUPAE: DOMINICAN REPUBLIC: LA VEGA PROV.: Lot 240, 6 pupae (MCM).

81. *Ephyriades brunneus* (Herrich-Schäffer)

Diagnosis. LAST INSTAR LARVA: BODY: length 14.5-21mm, A4 transverse width 3.6-4.8mm; green with numerous tiny yellow spots, heart line dark outlined with yellow, subdorsal line very narrow, yellow; some setae with expanded tips, < 0.1mm long on A4 dorsum; spiracles tan to pale. HEAD: Figure 26A, dark brown with orange patches at apex and laterally, orange eye patches present; transverse width 3.2-3.6mm; sculpturing rough to pebbly at apex; mandibles without teeth, or at most a few shallow lobes; setae simple, to 0.1mm long at apex, a few ventral setae to 1mm; stemmata subequal (Figure 40D); postocciput moderately wide. THORAX: legs pale; shield indistinct. ABDOMEN: prolegs each with about 130 crochets, irregularly triordinal, arranged in a circle, suranal plate rounded, unmarked (Figure 48D). PUPA:

Figures 66B and 86H, length 16-18mm, A3 transverse width 4.8-5.4mm; pale green; thoracic spiracle guard distinct; setae simple, to 0.4mm long on head; head rounded; antennal tip lies slightly cephalad of tip of middle leg; proboscis extending to the wing tips; abdomen moderately long; cremaster to 1.2mm long, blunt with numerous hooked setae in a cluster at the tip (Figures 104J and 116A).

Other Descriptions. Tamburo and Butcher 1955 (larva), Brown and Heineman 1972 (egg, larva, pupa), Minno and Emmel 1993 (larva, pupa).

Host Plants. MALPIGHIACEAE: *Byrsonima lucida* (Kimball 1965), *Malpighia glabra* (Butcher 1951). ROSACEAE: *Prunus* species (Brown and Heineman 1972) [erroneous].

Specimens Examined. LARVAE: FLORIDA: DADE CO.: Lot 779, 2 larvae (instars 4, 5) (USNM). MONROE CO.: Lot 149, 18 larvae (instar 5) (MCM); Lot 150, 8 larvae (instars 2, 4, 5) (MCM). PUPAE: FLORIDA: MONROE CO.: Lot 149, 8 pupae (MCM); Lot 150, 3 pupae (MCM).

82. *Erynnis icelus* (Scudder and Burgess)

Diagnosis. LAST INSTAR LARVA: BODY: length 12-23.5mm, A4 transverse width 4.1-5.1mm; green with numerous tiny white spots, heart line dark, subdorsal line narrow, yellow; setae simple, to 0.2mm long on A4 dorsum; spiracles tan to pale. HEAD: Figure 26B, brown, blackish around mouth, stemmata, vertex, and posterior; transverse width 3.3-3.5mm; sculpturing rough; mandibles without teeth; setae simple, to

0.2mm long at apex, a few ventral setae to 0.5mm; stemmata subequal (Figure 40E); postocciput moderately wide. THORAX: legs pale; shield indistinct. ABDOMEN: prolegs each with about 75 crochets, irregularly triordinal, arranged in a circle; suranal plate rounded, unmarked (Figure 48E). PUPA: Figures 66C and 87A, length 16-18mm, A3 transverse width 4.8-5.4mm; pale brown; thoracic spiracle guard a small black knob; setae simple, to 0.2mm long on head; head rounded; antennal and middle leg tips subequal; proboscis extending to the wing tips; abdomen moderately long; cremaster to 1mm long, tapering, blunt with numerous hooked setae in a cluster at the tip (Figures 104K and 116B).

Other Descriptions. Mead 1875 (egg), Edwards 1885a (larva, pupa), French 1886 (egg), Fletcher 1888 (egg), Scudder 1889a (egg, larva, pupa), Harrington 1892 (larva), Emmel et al. 1992 (larva, pupa).

Host Plants. BETULACEAE: *Betula lenta* (DHH collection), *Betula populifolia* (Shapiro 1966), *Corylus* species (Scudder 1889a,b, questionable; Burns 1964a, erroneous). FABACEAE: *Baptisia tinctoria* (Folsom 1896) [erroneous], *Baptisia* species (Scudder 1889a,b) [erroneous], *Robinia pseudoacacia* (Schaffner and Griswold 1934). FAGACEAE: *Quercus ilicifolia* (Craighead 1950) [erroneous], *Quercus rubra* (Craighead 1950) [erroneous], *Quercus velutina* (Craighead 1950) [erroneous]. HAMAMELIDACEAE: *Hamamelis virginiana* (Scudder 1889a,b, possibly) [questionable]. SALICACEAE:

Populus balsamifera (Burns 1964a), *Populus grandidentata* (Shapiro and Shapiro 1973), *Populus nigra* (Shapiro 1966), *Populus tremuloides* (Edwards 1885a), *Salix bebbiana* (McCabe 1991), *Salix cordata* (Fletcher 1888).

Specimens Examined. LARVAE: COLORADO: TELLER CO.: Lot 158, 5 larvae (instar 5) (MCM). INDIANA: BROWN CO.: Lot 209, 1 larva (instar 5) (MCM). NEW YORK: TOMPKINS CO.: Lot 547, 1 larva (instar 5) (TLM). VIRGINIA: GILES CO.: Lot 1242, 1 larva (instar 3) (DHH). PUPAE: COLORADO: TELLER CO.: Lot 158, 2 pupae (MCM).

83. *Erynnis brizo* (Boisduval and Leconte)

Diagnosis. LAST INSTAR LARVA: BODY: length 15-28mm, A4 transverse width 3.6-6mm; green with numerous tiny yellow spots, heart line dark, subdorsal line narrow, yellow; some setae with expanded tips, < 0.1mm long on A4 dorsum; spiracles tan to pale. HEAD: Figure 26C, brown, yellowish eye patches present; transverse width 3.6-4.4mm; sculpturing rough; mandibles without teeth; setae simple, to 0.1mm long at apex, a few ventral setae to 0.6mm; stemma 5 slightly small, 6 slightly large (Figure 40F); postocciput moderately wide. THORAX: legs pale; shield indistinct. ABDOMEN: prolegs each with about 90 crochets, irregularly triordinal, arranged in a near circle. PUPA: Figures 66D and 87B, length 18.5mm, A3 transverse width 4.7mm; pale brown; thoracic spiracle guard a small black knob; setae simple, < 0.1mm long on head; head rounded; antennal tip lies slightly

cephalad of tip of middle leg; proboscis extending to the wing tips; abdomen long; cremaster to 1.3mm long, tapering, blunt with numerous hooked setae in a cluster at the tip (Figures 104L and 116C).

Other Descriptions. Scudder 1889a (egg, larva, pupa), Scott 1986 (larva, pupa).

Host Plants. BORAGINACEAE: *Cynoglossum morrisoni* (Edwards 1885a) [erroneous], *Cynoglossum officiale* (Duffy and Garland 1978) [erroneous]. FABACEAE: *Baptisia tinctoria* (Harris 1972) [erroneous], *Baptisia* species (Scudder 1872) [erroneous], *Galactia regularis* (Scudder 1881) [erroneous], *Lespedeza* species (Klots 1951, dubious; Duffy and Garland 1978) [erroneous], *Sesbania longifolia* (Mather and Mather 1958) [erroneous]. FAGACEAE: *Castanea dentata* (Shapiro 1966), *Quercus chapmanii* (MCM collection), *Quercus dumosa* (MacNeill 1975, possibly), *Quercus durata* (Burns 1964a), *Quercus fusiformis* (Kendall 1966b, in lab), *Quercus gambelii* (Burns 1964a), *Quercus harvardii* (ROK collection), *Quercus ilicifolia* (Scudder 1889a,b), *Quercus inopina* (Minno 1992), *Quercus laevis* (MCM collection), *Quercus lobata* (Burns 1964a, in lab), *Quercus macrocarpa* (McCabe and Post 1977), *Quercus myrtifolia* (Minno 1992), *Quercus turbinella* (Burns 1964a), *Quercus undulata* (Burns 1964a).

Specimens Examined. LARVAE: FLORIDA: HIGHLANDS CO.: Lot 157, 5 larvae (instars 2, 5) (MCM). LEVY CO.: Lot 154, 2 larvae (instar 5) (MCM). MARION CO.: Lot 155, 4 larvae

(instars 4, 5) (MCM); Lot 156, 4 larvae (instars 3, 4).

PUTNAM CO.: Lot 709, 1 larva (instar 4) (MCM). TEXAS:

MOTLEY CO.: Lot 935, 4 larvae (instars 3, 4, 5) (ROK).

PUPAE: FLORIDA: HIGHLANDS CO.: Lot 157, 1 pupa (MCM).

84. *Erynnis juvenalis* (Fabricius)

Diagnosis. LAST INSTAR LARVA: BODY: length 17-25mm, A4 transverse width 4.1-6mm; green with numerous tiny white spots, heart line dark, subdorsal line narrow, yellow; some setae with blunt tips, < 0.1mm long on A4 dorsum; spiracles tan. HEAD: Figure 26D, brown with orange patches at apex and laterally, blackish around the mouth, orangish eye patches present; transverse width 4.1-6mm; sculpturing rough, small spines at apex; mandibles without teeth; setae simple, to 0.1mm long at apex, a few ventral setae to 0.6mm; stemmata subequal (Figure 40G); postocciput moderately wide.

THORAX: legs pale; shield indistinct. ABDOMEN: prolegs each with about 90 crochets, multiordinal, ca. 2-3 ranks, arranged in a near circle. PUPA: Figures 66E and 87C, length 16.5-19mm, A3 transverse width 4.5-5.8mm; pale green; thoracic spiracle guard a small black knob; setae simple, to 0.3mm long on head; head rounded; antennal tip lies slightly cephalad of tip of middle leg; proboscis extending to the wing tips; abdomen short; cremaster to 1.3mm long, constricted, blunt with numerous hooked setae in a cluster at the tip (Figures 104M and 116D).

Other Descriptions. Harris 1862 (larva, pupa), Saunders 1869b (larva), Scudder 1881 (larva, pupa), Scudder 1889a (egg, larva, pupa), Scott 1986 (egg, larva, pupa).

Host Plants. BETULACEAE: *Corylus americana* (McCabe and Post 1977) [possibly], *Corylus* species (Saunders 1869b). FABACEAE: *Apios americana* (French 1886) [erroneous], *Baptisia* species (Middleton 1881) [erroneous], *Galactia regularis* (Scudder 1889a,b) [erroneous], *Galactia volubilis* (Scudder 1889a,b) [erroneous], *Glycine* species (Harris 1862) [erroneous], *Lathyrus* species (Harris 1862) [erroneous], *Lotus* species (Basinger 1926) [erroneous]. FAGACEAE: *Fagus americana* (Scott 1986, probably), *Quercus agrifolia* (Burns 1964a, in lab), *Quercus alba* (Scudder 1889a,b), *Quercus arizonica* (Burns 1964a), *Quercus chapmanii* (MCM collection), *Quercus emoryi* (Burns 1964a, probably; MacNeill 1975), *Quercus falcata* (MCM collection), *Quercus fusiformis* (ROK collection), *Quercus gambelii* (Burns 1964a, possibly), *Quercus hypoleucoides* (Burns 1964a, probably; MacNeill 1975), *Quercus ilicifolia* (Scudder 1889a,b), *Quercus inopina* (Minno 1992), *Quercus laevis* (MCM collection), *Quercus lobata* (Burns 1964a, in lab), *Quercus macrocarpa* (McCabe and Post 1977), *Quercus marilandica* (Kendall 1966a), *Quercus mohriana* (Burns 1964a, probably; MacNeill 1975), *Quercus muehlenbergii* (Klots 1951), *Quercus nigra* (MacNeill 1975), *Quercus phellos* (Scudder 1889a,b, probably; Tietz 1952), *Quercus prinus* (Scudder 1889a,b), *Quercus rubra* (Craighead

1950), *Quercus stellata* (Kendall 1966a), *Quercus velutina* (Craighead 1950).

Specimens Examined. LARVAE: MEXICO: NUEVO LEON: Lot 937, 1 larva (instar 5) (ROK). INDIANA: PULASKI CO.: Lot 178, 7 larvae (instar 5) (MCM); Lot 179, 2 larvae (instar 3) (MCM); Lot 181, 4 larvae (instar 2) (MCM); Lot 182, 5 larvae (instars 4, 5) (MCM); Lot 183, 7 larvae (instar 4) (MCM); Lot 184, 1 larva (instar 5) (MCM); Lot 185, 2 larvae (instar 5) (MCM); Lot 186, 1 larva (instar 5) (MCM); Lot 559, 1 larva (instar 5) (JRH); Lot 714, 1 larva (instar 4) (MCM); Lot 715, 1 larva (instar 5) (MCM); Lot 782, 1 larva (instar 5) (USNM). PUPAE: MEXICO: NUEVO LEON: Lot 937, 1 pupa (ROK). INDIANA: PULASKI CO.: Lot 180, 6 pupae (MCM).

85. *Erynnis telemachus* Burns

The immature stages of this species are undescribed, and I could not locate specimens for study. Burns (1964a) found larvae on *Quercus gambelii* and reared these in the laboratory on *Quercus lobata*.

86. *Erynnis propertius* (Scudder and Burgess)

Diagnosis. LAST INSTAR LARVA: BODY: length 32mm, A4 transverse width 6mm; preserved specimen pale; some setae with blunt tips, to 0.1mm long on A4 dorsum; spiracles tan. HEAD: Figure 26E, brown with pale orange patches at apex and laterally, pale orange eye patches present; transverse width 4.4mm; sculpturing pebbly, small spines at apex; mandibles without teeth; setae simple, to 0.1mm long at

apex, a few ventral setae to 0.7mm; stemmata subequal (Figure 40H); postocciput moderately wide. THORAX: legs pale; shield indistinct. ABDOMEN: prolegs each with about 105 crochets, irregularly triordinal, arranged in a circle. Other Descriptions. Emmel and Emmel 1973 (pupa), Pyle 1981 (egg, larva, pupa).

Host Plants. FAGACEAE: *Quercus agrifolia* (Burns 1964a), *Quercus garryana* (Burns 1964a), *Quercus virginiana* (Tietz 1972).

Specimens Examined. LARVAE: OREGON: BENTON CO.: Lot 636, 1 larva (instar 5) (TCE).

87. *Erynnis meridianus* Bell

The immature stages of this species are undescribed, and I could not locate specimens for study.

Host Plants. FAGACEAE: *Quercus alba* (Burns 1964a, in lab), *Quercus arizonica* (Burns 1964), *Quercus fusiformis* (Burns 1964a).

88. *Erynnis scudderri* (Skinner)

Nothing is known of the biology of this species.

89. *Erynnis horatius* (Scudder and Burgess)

Diagnosis. EGG: Figure 4C, height 0.9mm, width 0.7-0.8mm, 13 ribs, yellow to orange. LAST INSTAR LARVA: BODY: Figure 19H, length 12-30.5mm, A4 transverse width 4-6.2mm; green with numerous tiny white spots; some setae with blunt tips, to 0.1mm long on A4 dorsum; spiracles tan. HEAD: Figure 26F, brown with orange patches at apex and laterally,

blackish around the mouth and stemmata, orangish eye patches present; transverse width 3.7-4.8mm; sculpturing rough to pebbly; mandibles without teeth; setae simple, to 0.1mm long at apex, a few ventral setae to 0.5mm; stemmata subequal (Figure 40I); postocciput moderately wide. THORAX: legs pale; shield indistinct. ABDOMEN: prolegs each with about 105 crochets, multiordinal, ca. 2-3 ranks, arranged in a circle or near circle. PUPA: Figures 66F and 87D, length 17-21mm, A3 transverse width 5.7-6.3mm; pale green, often with a black patch on the anterior margin of the proboscis; thoracic spiracle guard a small black knob; setae simple, to 0.2mm long on head; head rounded; antennal tip lies far cephalad of tip of middle leg; proboscis extending to the wing tips; abdomen moderately long; cremaster to 1.4mm long, constricted, blunt with numerous hooked setae in a cluster at the tip (Figures 104N and 116E).

Other Descriptions. Scudder 1889a (larva, pupa).

Host Plants. FABACEAE: *Wisteria frutescens* (Scudder 1889a,b) [erroneous]. FAGACEAE: *Quercus alba* (Burns 1964a, in lab), *Quercus chapmanii* (MCM collection), *Quercus falcata* var. *pagodaefolia* (Scott 1986), *Quercus fusiformis* (Burns 1964a), *Quercus gambelii* (Burns 1964a, associated with; Kendall 1965, in lab), *Quercus geminata* (MCM collection), *Quercus hemisphaerica* (Kendall 1965), *Quercus ilicifolia* (Burns 1964a), *Quercus inopina* (Minno 1992), *Quercus laurifolia* (Kendall 1965), *Quercus laevis* (MCM collection),

Quercus marilandica (Kendall 1965), *Quercus muehlenbergii* (Shapiro 1966), *Quercus myrtifolia* (Minno 1992), *Quercus nigra* (Ross and Lambremont 1963), *Quercus phellos* (Kendall 1965), *Quercus rubra* (Scott 1986), *Quercus shumardii* (Burns 1964a), *Quercus stellata* (Burns 1964a), *Quercus stellata* var. *margareta* (MCM collection), *Quercus texana* (Burns 1964a), *Quercus velutina* (Opler and Krizek 1984), *Quercus virginiana* (Burns 1964a).

Specimens Examined. EGGS: FLORIDA: ALACHUA CO.: Lot 1533, 2 eggs (MCM). LARVAE: FLORIDA: ALACHUA CO.: Lot 168, 3 larvae (instar 5) (MCM); Lot 169, 1 larva (instar 5) (MCM); Lot 170, 1 larva (instar 5) (MCM); Lot 172, 2 larvae (instar 5) (MCM); Lot 173, 2 larvae (instar 5) (MCM); Lot 175, 2 larvae (instar 5) (MCM); Lot 176, 3 larvae (instars 3, 5) (MCM); Lot 177, 1 larva (instar 4) (MCM); Lot 711, 1 larva (instar 5) (MCM). BROWARD CO.: Lot 164, 1 larva (instar 5) (MCM); Lot 165, 1 larva (instar 4) (MCM); Lot 166, 2 larvae (instar 5) (MCM). HIGHLANDS CO.: Lot 6, 2 larvae (instar 5) (MCM); Lot 712, 1 larva (instar 5) (MCM). MARION CO.: Lot 171, 1 larva (instar 4) (MCM). PUTNAM CO.: Lot 710, 2 larvae (instar 5) (MCM); Lot 713, 1 larva (instar 5) (MCM); Lot 1508, 1 larva (instar 4) (MCM). PUPAE: FLORIDA: ALACHUA CO.: Lot 168, 1 pupa (MCM); Lot 173, 1 pupa (MCM). BROWARD CO.: Lot 163, 1 pupa (MCM); Lot 166, 1 pupa (MCM).

90. *Erynnis tristis* (Boisduval)

Diagnosis. LAST INSTAR LARVA: BODY: length 15-29mm, A4 transverse width 3.3-5.8mm; green, heart line dark, subdorsal line very narrow, pale yellow; some setae with blunt or slightly expanded tips, to 0.1mm long on A4 dorsum; spiracles tan. HEAD: Figure 27A, pale brown with pale orange patches at apex and laterally, posterior dark brown, small pale orange eye patches present; transverse width 3.8-4.8mm; sculpturing rough, small spines at apex; mandibles without teeth; setae simple, to 0.2mm long at apex, a few ventral setae to 0.8mm; stemmata subequal (Figure 40J); postocciput moderately wide. THORAX: legs pale; shield indistinct. ABDOMEN: prolegs each with about 90 crochets, multiordinal, ca. 2-3 ranks, arranged in a circle or near circle. PUPA: Figures 66G and 87E, length 14.5-16mm, A3 transverse width 4.4-4.7mm; preserved specimen pale; thoracic spiracle guard a small black knob; setae simple, to 0.2mm long on head; head rounded; antennal tip lies slightly cephalad of tip of middle leg; proboscis extending to the wing tips; abdomen short; cremaster to 1.5mm long, slightly constricted, blunt with numerous hooked setae in a cluster at the tip (Figures 1040 and 116F).

Other Descriptions. Comstock and Dammers 1932a (egg, larva, pupa), Emmel and Emmel 1973 (egg, larva, pupa).

Host Plants. FABACEAE: *Lotus* species (Wright 1905) [erroneous]. FAGACEAE: *Quercus agrifolia* (Burns 1964a),

Quercus devia (Burns 1964a, associated with), *Quercus douglasii* (Burns 1964a), *Quercus dumosa* (Johnson 1982), *Quercus emoryi* (Burns 1964a, associated with; ROK collection), *Quercus grisea* (Burns 1964a, associated with; Bailowitz and Brock 1991), *Quercus hemisphaerica* (MCM collection, in lab), *Quercus idonea* (Burns 1964a, associated with), *Quercus lobata* (Burns 1964a), *Quercus suber* (Comstock and Dammers 1932a), *Quercus wislizenii* (Shapiro 1974b).

Specimens Examined. LARVAE: CALIFORNIA: SACRAMENTO CO.: Lot 187, 6 larvae (instar 5) (MCM). SAN DIEGO CO.: Lot 589, 2 larvae (instar 5) (GRB). TEXAS: BREWSTER CO.: Lot 938, 34 larvae (instars 2, 3, 4, 5) (ROK). PUPAE: TEXAS: BREWSTER CO.: Lot 938, 3 pupae (ROK).

91. *Erynnis martialis* (Scudder)

Diagnosis. LAST INSTAR LARVA: BODY: length 19-23.5mm, A4 transverse width 4.7-4.9mm; green, heart lined dark, subdorsal line narrow, pale yellow; setae simple, to 0.2mm long on A4 dorsum; spiracles tan. HEAD: Figure 27B, dark brown with pale orange patches at apex and laterally, posterior black, pale orange eye patches present; transverse width 3.3-3.7mm; sculpturing rough, small knobs at apex; mandibles with teeth; setae simple, to 0.2mm long at apex, a few ventral setae to 0.6mm; stemmata subequal (Figure 40K); postocciput moderately wide. THORAX: legs pale; shield indistinct. ABDOMEN: prolegs each with about 60 crochets, multiordinal, ca. 2-3 ranks, arranged in a circle. PUPA:

Figures 66H and 87F, length 16mm, A3 transverse width 5.3mm; green; thoracic spiracle guard a small black knob; setae simple, to 0.2mm long on head; head rounded; antennal tip lies far cephalad of tip of middle leg; proboscis extending to the wing tips; abdomen short; cremaster to 1.3mm long, constricted, blunt with numerous hooked setae in a cluster at the tip (Figures 104P and 116G).

Other Descriptions. Scudder 1889a (egg, larva, pupa).

Host Plants. AMARANTHACEAE: *Amaranthus retroflexus* (Tietz 1952) [erroneous], *Amaranthus* species (Holland 1898) [erroneous]. FABACEAE: *Amorpha* species (Klots 1951) [erroneous], *Baptisia* species (Forbes 1906, possibly) [erroneous], *Indigofera caroliniana* (Scudder 1889a,b) [erroneous]. HAEMODORACEAE: *Lachnanthes caroliniana* (Scudder 1889a,b, possibly) [erroneous]. RHAMNACEAE: *Ceanothus americanus* (Scudder 1889a,b), *Ceanothus cordulatus* (Scott 1986), *Ceanothus fendleri* (Scott and Scott 1980), *Ceanothus herbaceus* var. *pubescens* (Opler and Krizek 1984, associated with), *Ceanothus ovatus* (Scott 1986). ROSACEAE: *Adenostoma fasciculatum* (Tietz 1952) [erroneous]. ULMACEAE: *Trema micrantha* (Tietz 1952) [erroneous].

Specimens Examined. LARVAE: INDIANA: JASPER CO.: Lot 992, 2 larvae (instar 5)(MCM). PENNSYLVANIA: CHESTER CO.: Lot 1241, 1 larva (instar 5) (DHH). PUPAE: INDIANA: JASPER CO.: Lot 992, 1 pupa (MCM).

92. *Erynnis pacuvius* (Lintner)

Diagnosis. LAST INSTAR LARVA: BODY: length 30mm, A4 transverse width 6.3mm; preserved specimen pale; some setae with blunt tips, to 0.1mm long on A4 dorsum; spiracles tan. HEAD: Figure 27C, light brown with a darker brown patch across face, posterior dark brown; transverse width 3.3mm; sculpturing rough, small knobs at apex; mandibles with teeth; setae simple, to 0.1mm long at apex, a few ventral setae to 0.5mm; stemmata subequal (Figure 40L); postocciput moderately wide. THORAX: legs pale; shield indistinct. ABDOMEN: prolegs each with about 70 crochets, multiordinal, ca. 2-3 ranks, arranged in a circle or near circle.

Other Descriptions. Comstock and Dammers 1932b (egg), Pyle 1981 (egg, larva, pupa).

Host Plants. FAGACEAE: *Quercus* species (Beutelspacher 1980) [erroneous]. RHAMNACEAE: *Ceanothus cordulatus* (Burns 1964a), *Ceanothus fendleri* (Eff 1955), *Ceanothus oliganthus* (Burns 1964a).

Specimens Examined. LARVAE: CALIFORNIA: LOS ANGELES CO.: Lot 590, 1 larva (instar 5) (GRB).

93. *Erynnis zarucco* (Lucas)

Diagnosis. EGG: height 0.7-0.8mm, width 0.6-0.7mm, yellow to orange. LAST INSTAR LARVA: BODY: length 12-30mm, A4 transverse width 2.9-6.2mm; green with numerous tiny yellow spots, heart line dark, subdorsal line narrow, pale yellow; some setae with expanded tips, < 0.1mm long on A4 dorsum;

spiracles tan. HEAD: Figure 27D, light brown with orange patches, a dark W-shape on face, posterior black, occasionally mostly black or light brown; transverse width 3.1-4.1mm; sculpturing rough, small knobs at apex; mandibles with teeth; setae feathery, to 0.1mm long at apex, a few ventral setae to 0.4mm; stemmata subequal (Figure 40M); postocciput moderately wide. THORAX: legs pale; shield indistinct. ABDOMEN: prolegs each with about 95 crochets, irregularly triordinal, arranged in a circle or near circle. PUPA: Figures 67A and 87G, length 14.5-19.5mm, A3 transverse width 4.4-5.6mm; pale green; thoracic spiracle guard a small black knob; setae simple, to 0.2mm long on head; head rounded; antennal tip lies far cephalad of tip of middle leg; proboscis extending to the wing tips; abdomen short; cremaster to 1.3mm long, slightly constricted, blunt with numerous hooked setae in a cluster at the tip (Figures 105A and 116H).

Other Descriptions. Kendall 1961a (larva), Pyle 1981 (egg, larva, pupa), Scott 1986 (egg, larva, pupa), Minno and Emmel 1993 (egg, larva, pupa).

Host Plants. AMARANTHACEAE: *Amaranthus* species (Draudt 1924) [erroneous]. FABACEAE: *Baptisia lactea* (MCM collection), *Baptisia* species (Macy and Shepard 1941), *Centrosema virginianum* (Burns 1964a, probably; Scott 1986), *Clitoria mariana* (Burns 1964a, probably; Scott 1986), *Desmodium* species (Shapiro 1966, probably) [erroneous],

Galactia elliottii (Minno 1992), *Galactia regularis* (Minno 1992), *Galactia volubilis* (MCM collection), *Galactia wrightii* (Bailowitz and Brock 1991), *Glycine max* (DHH collection), *Indigofera caroliniana* (Minno 1992), *Indigofera suffruticosa* (MCM collection), *Lespedeza hirta* (Burns 1964a, probably), *Lysiloma bahamensis* (USNM collection) [erroneous], *Robinia pseudoacacia* (Kendall 1961a), *Sesbania grandiflora* (Bates 1935), *Sesbania longifolia* (Oppler and Krizek 1984), *Sesbania macrocarpa* (MacNeill 1975), *Sesbania punicea* (DHH collection, MCM collection, USNM collection), *Sesbania vescicaria* (Burns 1964a, probably; Scott 1986), *Vicia floridana* (DHH collection), *Wisteria frutescens* (Burns 1964a, probably; Scott 1986).

Specimens Examined. EGGS: FLORIDA: PUTNAM CO.: Lot 1534, 2 eggs (MCM); Lot 1538, 1 egg (MCM). LARVAE: FLORIDA: Lot 1256, 4 larva (instar 5) (DHH). ALACHUA CO.: Lot 197, 6 larvae (instar 5) (MCM); Lot 718, 3 larvae (instar 5) (MCM); Lot 780, 2 larvae (instar 5) (USNM); Lot 1209, 1 larva (instar 5) (DHH); Lot 1243, 1 larva (instar 5) (DHH); Lot 1244, 2 larvae (instar 5) (DHH); Lot 1247, 1 larva (instar 5) (DHH); Lot 1248, 2 larvae (instar 5) (DHH); Lot 1249, 2 larvae (instar 5) (DHH); Lot 1250, 1 larva (instar 5) (DHH); Lot 1251, 1 larva (instar 5) (DHH); Lot 1253, 1 larva (instar 5) (DHH); Lot 1254, 1 larva (instar 5) (DHH); Lot 1257, 1 larva (instar 5) (DHH); Lot 1258, 1 larva (instar 5) (DHH); Lot 1259, 1 larva (instar 5) (DHH); Lot 1260, 1 larva

(instar 5) (DHH); Lot 1261, 3 larvae (instar 5) (DHH); Lot 1263, 8 larvae (instars 3, 5) (DHH); Lot 1264, 1 larva (instar 5) (DHH). BAKER CO.: Lot 783, 2 larvae (instar 5) (USNM). DUVAL CO.: Lot 717, 1 larva (instar 5) (MCM); Lot 1262, 2 larvae (instar 5) (DHH). BREVARD CO.: Lot 781, 1 larva (instar 5) (USNM). HIGHLANDS CO.: Lot 189, 1 larva (instar 5) (MCM); Lot 190, 1 larva (instar 5) (MCM); Lot 191; 1 larva (instar 5) (MCM); Lot 192, 1 larva (instar 3) (MCM); Lot 193, 1 larva (instar 5) (MCM); Lot 198, 3 larvae (instar 5) (MCM). LAKE CO.: Lot 1252, 1 larva (instar 5) (DHH). LEON CO.: Lot 1245, 1 larva (instar 5) (DHH). LEVY CO.: Lot 196, 2 larvae (instar 5) (MCM); Lot 203, 1 larva (instar 5) (MCM). LIBERTY CO.: Lot 194, 2 larvae (instars 3, 5) (MCM). MARION CO.: Lot 1265, 2 larvae (instar 5) (DHH). MONROE CO.: Lot 205, 5 larvae (instar 5) (MCM); Lot 206, 5 larvae (instar 5) (MCM); Lot 208, 2 larvae (instar 5) (MCM); Lot 719, 1 larva (instar 5) (MCM). OSCEOLA CO.: Lot 200, 1 larva (instar 5) (MCM). PUTNAM CO.: Lot 202, 1 larva (instar 5) (MCM); Lot 716, 1 larva (instar 5) (MCM); Lot 1246, 1 larva (instar 5) (DHH). VOLUSIA CO.: Lot 195, 1 larva (instar 5) (MCM). GEORGIA: HARRIS CO.: Lot 188, 2 larvae (instar 5) (MCM). PUPAE: FLORIDA: ALACHUA CO.: Lot 199, 2 pupae (MCM); Lot 1243, 2 pupae (DHH). BAKER CO.: Lot 783, 1 pupa (USNM); Lot 1256, 3 pupae (DHH). LIBERTY CO.: Lot 194, 1 pupa (MCM). MARION CO.: Lot 201, 1 pupa (MCM). MONROE CO.: Lot 205, 1 pupa (MCM); Lot 206, 1 pupa

(MCM); Lot 207, 1 pupa (MCM); Lot 208, 2 pupae (MCM).

PUTNAM CO.: Lot 720, 1 pupa (MCM).

94. *Erynnis funeralis* (Scudder and Burgess)

Diagnosis. EGG: height 0.7-0.8mm, width 0.6-0.7mm, 12-16 ribs. LAST INSTAR LARVA: BODY: length 20-34mm, A4 transverse width 3.8-6mm; preserved specimens pale, subdorsal line narrow, pale yellow; some setae with expanded tips, < 0.1mm long on A4 dorsum; spiracles pale. HEAD: Figure 27E, black with orange patches at apex and lateral margin or light brown with a dark W-shape on face, orange eye patches present; transverse width 3.8-6mm; sculpturing rough, small knobs at apex; mandibles with teeth; setae feathery, to 0.1mm long at apex, a few ventral setae to 0.4mm; stemmata subequal (Figure 40N); postocciput moderately wide. THORAX: legs pale; shield indistinct. ABDOMEN: prolegs each with about 90 crochets, irregularly triordinal, arranged in a circle or near circle. PUPA: Figures 67B and 87H, length 17-20mm, A3 transverse width 4.8-6.2mm; preserved specimens pale; thoracic spiracle guard a small black knob; setae simple, to 0.2mm long on head; head rounded; antennal tip lies far cephalad of tip of middle leg; proboscis extending to the wing tips; abdomen short; cremaster to 1.4mm long, constricted, blunt with numerous hooked setae in a cluster at the tip (Figures 105B and 116I).

Other Descriptions. Coquillett 1899 (larva), Coolidge 1924 (egg, larva, pupa), Comstock 1927b (egg, larva, pupa), Comstock 1930b (egg, larva, pupa), Kendall 1961a (larva), Emmel and Emmel 1973 (egg, larva, pupa), Hogue 1974 (larva).

Host Plants. FABACEAE: *Astragalus* species (Brown et al. 1992), *Cracca edwardsi* (Bailowitz and Brock 1991), *Geoffroea decorticans* (Hayward 1941), *Indigofera leptosepala* (Kendall 1960), *Lotus crassifolius* (GRB collection), *Lotus grandiflorus* (Tietz 1972), *Lotus scoparius* (Coquillett 1899), *Medicago hispida* (Field 1938), *Medicago sativa* (Coolidge 1924), *Olneya tesota* (Burns 1964a), *Robinia neomexicana* (Burns 1964a), *Sesbania drummondii* (Scott 1986), *Sesbania macrocarpa* (Emmel and Emmel 1973), *Vicia leavenworthii* (ROK collection), *Vicia texana* (Kendall 1960).

HYDROPHYLACEAE: *Nemophila membranacea* (Coolidge 1924) [erroneous]. MALPIGHIACEAE: *Malpighia glabra* (ROK collection).

Specimens Examined. EGGS: TEXAS: BEXAR CO.: Lot 940, 6 eggs (ROK). LARVAE: USA: NO DATA: Lot 551, 1 larva (instar 5) (NM). CALIFORNIA: SAN BERNARDINO CO.: Lot 591, 1 larva (instar 5). TEXAS: BEXAR CO.: Lot 939, 1 larva (instar 5) (ROK); Lot 940, 2 larvae (instar 5) (ROK). CAMERON CO.: Lot 936, 24 larvae (instars 2, 3, 4, 5) (ROK). PUPAE: TEXAS: BEXAR CO.: Lot 939, 2 pupae (ROK); Lot 940, 3 pupae (ROK). CAMERON CO.: Lot 936, 3 pupae (ROK).

95. *Erynnis lucilius* (Scudder and Burgess)

I could not find specimens of this northeastern species for study.

Other Descriptions. Lintner 1878 (egg, larva, pupa), Scudder 1889a (egg, larva, pupa), Lindsey 1927 (larva).

Host Plants. CHENOPODIACEAE: *Chenopodium album* (Scudder 1889a,b) [erroneous]. RANUNCULACEAE: *Aquilegia brevistyla* (Klassen et al. 1989, possibly), *Aquilegia canadensis* (Lintner 1872), *Aquilegia vulgaris* (Shapiro 1974a). SALICACEAE: *Populus* species (Mead 1875) [erroneous], *Salix* species (Mead 1875) [erroneous].

96. *Erynnis baptisiae* (Forbes)

Diagnosis. LAST INSTAR LARVA: BODY: length 17-26mm, A4 transverse width 4.3-5.1mm; green, heart line dark, subdorsal line narrow, pale yellow; some setae with expanded tips, < 0.1mm long on A4 dorsum; spiracles tan. HEAD: Figure 27F, dark brown or black with pale orange patches on apex and laterally, orange eye patches present, occasionally uniformly black or light brown with a dark W-shape on the face; transverse width 3.1-3.7mm; sculpturing rough, small knobs at apex; mandibles with teeth; setae simple, to 0.1mm long at apex, a few ventral setae to 0.2mm; stemmata subequal (Figure 400); postoccipt moderately wide. THORAX: legs pale; shield indistinct. ABDOMEN: prolegs each with about 70 crochets, multiordinal, ca. 2-3 ranks, arranged in a circle or near circle. PUPA: Figures 67C and 88A, length

13.5-17mm, A3 transverse width 4-5.2mm; pale green; thoracic spiracle guard a small black knob; setae simple, to 0.1mm long on head; head rounded; antennal tip lies far cephalad of tip of middle leg; proboscis extending to the wing tips; abdomen short; cremaster to 1.2mm long, constricted, blunt with numerous hooked setae in a cluster at the tip (Figures 105C and 116J).

Other Descriptions. Pyle 1981 (egg, larva, pupa).

Host Plants. FABACEAE: *Amorpha canescens* (Ebner 1970), *Astragalus canadensis* (Scott 1986), *Baptisia australis* (Opler and Krizek 1984), *Baptisia leucantha* (Burns 1964a), *Baptisia leucophaea* var. *laevicaulis* (Kendall 1965), *Baptisia tinctoria* (Forbes 1936, associated with; Comstock 1940), *Coronilla varia* (Wheeler 1974), *Crotalaria sagittalis* (Opler and Krizek 1984, possibly; Scott 1986), *Crotalaria* species (Shapiro 1966, possibly), *Lupinus perennis* (Shapiro 1974a), *Sesbania vescicaria* (ROK collection), *Thermopsis mollis* (Scott 1986, in lab), *Thermopsis villosa* (Opler and Krizek 1984). RANUNCULACEAE: *Aquilegia* species (Burns 1964a, in lab).

Specimens Examined. LARVAE: INDIANA: TIPPECANOE CO.: Lot 151, 3 larvae (instar 5) (MCM); Lot 153, 1 larva (instar 5) (MCM). KENTUCKY: WHITLEY CO.: Lot 993, 2 larvae (instar 5) (MCM). PENNSYLVANIA: MONTGOMERY CO.: Lot 1000, 2 larvae (instar 5) (FSCA). TEXAS: WILSON CO.: Lot 934, 4 larvae (instar 5) (ROK). PUPAE: INDIANA: JASPER CO.: Lot 152, 1

pupa (MCM). KENTUCKY: WHITLEY CO.: Lot 993, 1 pupa (MCM).

TEXAS: BASTROP CO.: Lot 568, 1 pupa (JRH).

97. *Erynnis afranius* (Lintner)

Diagnosis. LAST INSTAR LARVA: BODY: length 25mm, A4 transverse width 4.3mm; preserved specimen pale; some setae with expanded tips, < 0.1mm long on A4 dorsum; spiracles tan. HEAD: Figure 27G, light brown with a dark W-shape on the face; transverse width 2.8mm; sculpturing rough, pebbly at apex; mandibles with teeth; setae simple, to 0.1mm long at apex, a few ventral setae to 0.4mm; stemmata subequal (Figure 40P); postocciput moderately wide. THORAX: legs pale; shield indistinct. ABDOMEN: prolegs each with about 70 crochets, irregularly triordinal, arranged in a circle.

Other Descriptions. Lindsey 1927 (larva), Comstock and Dammers 1932b (egg?, larva, pupa), Emmel and Emmel 1973 (egg, larva, pupa), McCabe and Post 1977 (larva).

Host Plants. FABACEAE: *Astragalus* species (Scott and Scott 1980), *Lotus purshianus* (Comstock and Dammers 1932b), *Lotus scoparius* (Tilden and Smith 1986), *Lupinus argenteus* (Scott and Scott 1980), *Lupinus* species (Lindsey 1927), *Thermopsis rhombifolia* (Royer 1988, possibly), *Trifolium* species (Comstock 1927b). RHAMNACEAE: *Ceanothus oliganthus* (Comstock and Dammers 1932b) [erroneous]. SALICACEAE: *Populus* species (Comstock 1927b) [erroneous], *Salix* species (Comstock 1927b) [erroneous].

Specimens Examined. LARVAE: CALIFORNIA: SAN DIEGO CO.:

Lot 592, 1 larva (instar 5) (GRB).

98. *Erynnis persius* (Scudder)

Diagnosis. LAST INSTAR LARVA: BODY: length 16-22.5mm, A4 transverse width 3.3-4.8mm; green with numerous tiny white spots, heart line dark, subdorsal line narrow, pale yellow; some setae with blunt tips, < 0.1mm long on A4 dorsum; spiracles tan. HEAD: Figure 27H, light brown with a dark W-shape on the face, area around the mouth, stemmata, and posterior dark brown; transverse width 2.7-3.2mm; sculpturing rough, small knobs at apex; mandibles with teeth; setae simple, to 0.1mm long at apex, a few ventral setae to 0.5mm; stemmata subequal (Figure 40Q); postocciput moderately wide. THORAX: legs pale; shield indistinct. ABDOMEN: prolegs each with about 60 crochets, irregularly triordinal, arranged in a circle or near circle. PUPA: Figures 67D and 88B, length 15-16mm, A3 transverse width 4.5-4.8mm; pale green; thoracic spiracle guard a small black knob; setae simple, to 0.2mm long on head; head rounded; antennal tip lies far cephalad of tip of middle leg; proboscis extending to the wing tips; abdomen short; cremaster to 1.1mm long, constricted, blunt with numerous hooked setae in a cluster at the tip (Figures 105D and 116K).

Other Descriptions. Scudder 1889a (egg, larva, pupa), Folsum 1896 (egg), Comstock 1927b (egg, larva, pupa), Lindsey 1927 (larva), Emmel et al. 1992 (larva).

Host Plants. FABACEAE: *Astragalus flexuosus* (Scott 1986), *Astragalus bisulcatus* (Scott and Scott 1980, probably), *Baptisia tinctoria* (Tietz 1952), *Baptisia* species (Wild 1939), *Galactia* species (Davenport and Dethier 1938), *Lespedeza capitata* (Scudder 1881), *Lotus purshianus* (Tietz 1952), *Lotus scoparius* (Scott 1986, probably), *Lupinus argenteus* (Scott 1986), *Lupinus latifolius* (Scott 1986), *Lupinus perennis* (Opler and Krizek 1984), *Oxytropis splendens* (Emmel et al. 1992), *Thermopsis divaricarpa* (Scott 1986), *Thermopsis macrophylla* (Burns 1964a), *Thermopsis pinetorum* (Burns 1964a), *Trifolium ciliolatum* (Tietz 1952). FAGACEAE: *Quercus ilicifolia* (Davenport and Dethier 1938) [erroneous]. RANUNCULACEAE: *Aquilegia canadensis* (Saunders 1869b, possibly) [erroneous]. RHAMNACEAE: *Ceanothus oliganthus* (Tietz 1952) [erroneous]. SALICACEAE: *Populus balsamifera* (Scudder 1881) [erroneous], *Populus grandidentata* (Scudder 1889a,b) [erroneous], *Populus tremuloides* (Scudder 1889a,b) [erroneous], *Salix humilis* (Scudder 1881) [erroneous], *Salix sericea* (Shapiro 1966, probably) [erroneous], *Salix* species (Edwards 1885a) [erroneous].

Specimens Examined. LARVAE: COLORADO: FREMONT CO.: Lot 159, 4 larvae (instar 5) (MCM); Lot 160, 5 larvae (instar 5)

(MCM); Lot 161, 5 larvae (instar 5) (MCM); Lot 162, 2 larvae (instar 5) (MCM). PUPAE: PENNSYLVANIA: CLINTON CO.: Lot 161, 2 pupae (MCM).

99. *Pyrgus centaureae* (Rambur)

Diagnosis. EGG: height 0.8-0.9mm, width 0.5-0.8mm, 16-20 ribs, pale green to white. LAST INSTAR LARVA: BODY: length 12-22.5mm, A4 transverse width 2.8-3.8mm; green with numerous tiny white spots, heart line dark, subdorsal and lateral lines narrow, white; some setae with slightly expanded tips, to 0.5mm long on A4 dorsum; spiracles tan. HEAD: Figure 28A, black; transverse width 2.6-3.1mm; sculpturing rough; mandibles with teeth; setae simple, to 0.4mm long at apex, a few ventral setae to 0.6mm; stemmata subequal (Figure 40R); postocciput moderately wide. THORAX: legs dark brown; shield broad, tan. ABDOMEN: prolegs each with about 30 crochets, multiordinal, ca. 2-3 ranks, arranged in a mesal penellipse; suranal plate rounded, unmarked (Figure 48F).

Other Descriptions. Emmel et al. 1992 (larva).

Host Plants. LAMIACEAE: *Mentha* species (Scudder 1889a,b) [erroneous]. ROSEACEAE: *Fragaria virginiana* (Opler and Krizek 1984), *Fragaria* species (Scott and Scott 1980), *Potentilla canadensis* (Clark and Clark 1951, associated with), *Potentilla diversifolia* (Scott and Scott 1980).

Specimens Examined. EGGS: COLORADO: PARK CO.: Lot 451, 2 eggs (MCM). LARVAE: COLORADO: PARK CO.: Lot 451, 13 larvae (instars 1, 2, 5) (MCM).

100. *Pyrgus ruralis* (Boisduval)

Diagnosis. LAST INSTAR LARVA: BODY: length 24.5mm, A4 transverse width 3.6mm; preserved specimen pale; some setae with slightly expanded tips, to 0.2mm long on A4 dorsum; spiracles tan. HEAD: dark brown; transverse width 2.7mm; sculpturing rough; mandibles with teeth; setae simple, to 0.2mm long at apex, a few ventral setae to 0.7mm; stemmata subequal (Figure 40S); postocciput moderately wide. THORAX: T1 legs brown, T2-3 legs pale; shield broad, brown. ABDOMEN: prolegs each with about 40 crochets, multiordinal, ca. 2-3 ranks, arranged in a mesal penellipse.

Other Descriptions. Coolidge 1909 (egg).

Host Plants. MALVACEAE: *Sidalcea malvaeflora* (Garth and Tilden 1986, questionable) [erroneous]. ROSEACEAE: *Horkelia bolanderi* var. *clevelandii* (Emmel and Emmel 1973, probably), *Horkelia fusca* (Lembert 1894), *Horkelia tenuiloba* (Comstock 1927b), *Potentilla ambigens* (Stanford 1981), *Potentilla drummondii* (Emmel and Emmel 1962, probably).

Specimens Examined. LARVAE: CALIFORNIA: SAN DIEGO CO.: Lot 587, 1 larva (instar 5) (GRB).

101. *Pyrgus xanthus* Edwards

The immature stages of this species are undescribed, but the larvae feed on roseaceous plants such as *Potentilla*

ambigens (Scott 1975b, associated with), *Potentilla hippiana* (Scott and Scott 1980), and *Potentilla pulcherrima* (Scott 1986).

102. *Pyrgus scriptura* (Boisduval)

Diagnosis. LAST INSTAR LARVA: BODY: length 12.5-22.5mm, A4 transverse width 2.6-4.2mm; green, heart line dark; some setae with expanded tips, to 0.2mm long on A4 dorsum; spiracles tan. HEAD: black; transverse width 2-2.3mm; sculpturing rough; mandibles with teeth; setae slightly feathery, to 0.2mm long at apex, a few ventral setae to 0.6mm; stemmata subequal (Figure 40T); postocciput moderately wide. THORAX: T1 legs light brown, T2-3 legs tan to pale; shield indistinct or anterior tan, posterior brown. ABDOMEN: prolegs each with about 40 crochets, multiordinal, ca. 2-3 ranks, arranged in a circle. PUPA: Figures 67E and 88C, length 11-14mm, A3 transverse width 3.9-4.3mm; dark brown; thoracic spiracle guard distinct; some setae bifurcate, to 0.6mm long on head; head rounded; antennal tip lies far cephalad of tip of middle leg; proboscis extending to the wing tips; abdomen moderately long; cremaster to 0.9mm long, blunt with numerous hooked setae in a cluster at the tip (Figures 105E and 116L).

Other Descriptions. Emmel et al. 1992 (larva, pupa).

Host Plants. MALVACEAE: *Sida hederacea* (Davenport and Dethier 1938), *Sphaeralcea ambigua* (Scott 1986), *Sphaeralcea coccinea* (Scott 1975b).

Specimens Examined. LARVAE: CALIFORNIA: RIVERSIDE CO.: Lot 586, 2 larvae (instar 5) (GRB). YOLO CO.: Lot 465, 11 larvae (instar 5) (MCM). PUPAE: CALIFORNIA: YOLO CO.: Lot 465, 7 pupae (MCM).

103. *Pyrgus communis* (Grote)

Diagnosis. EGG: height 0.7mm, width 0.6mm, 20 ribs, pale green to white. LAST INSTAR LARVA: BODY: length 12-28mm, A4 transverse width 2.6-4.8mm; green, heart line dark; some setae with slightly expanded tips, to 0.3mm long on A4 dorsum; spiracles tan. HEAD: black; transverse width 2.1-3.1mm; sculpturing rough; mandibles with teeth; setae branching, to 0.2mm long at apex, a few ventral setae to 0.6mm; stemmata subequal (Figure 40U); postocciput moderately wide. THORAX: T1-2 legs dark brown, T3 legs tan to pale; shield broad, anterior light brown, posterior dark brown. ABDOMEN: prolegs each with about 50 crochets, multiordinal, ca. 2-3 ranks, arranged in a circle. PUPA: Figures 58H, 67F, and 88D, length 13-17mm, A3 transverse width 3.9-5.2mm; green with dark markings; thoracic spiracle guard distinct; some setae bifurcate, to 0.5mm long on head; head rounded; antennal tip lies far cephalad of tip of middle leg; proboscis extending to the wing tips; abdomen moderately long; cremaster to 1.3mm long, blunt with numerous hooked setae in a cluster at the tip (Figures 105F and 117A).

Other Descriptions. Scudder 1889a (egg, larva, pupa), Comstock 1927b (egg, larva, pupa), Dethier 1944b (egg, larva, pupa), Emmel et al. 1992 (egg, larva, pupa).

Host Plants. CHENOPODIACEAE: *Chenopodium album* (Shapiro 1968; oviposition, but larva refused it). MALVACEAE: *Abutilon abutiloides* (Comstock 1940), *Abutilon theophrasti* (Scudder 1889a,b), *Althaea officinalis* (Shapiro and Shapiro 1973, possibly), *Althaea rosea* (French 1897), *Althaea* species (Scudder 1889a,b), *Anoda lavaterioides* (Hayward 1947), *Callirhoe leiocarpa* (Kendall 1965), *Hibiscus trionum* (Comstock 1940), *Iliamna* species (Field 1938), *Malva moschata* (Shapiro 1968), *Malva neglecta* (French 1897), *Malva nicaeensis* (Coolidge 1908), *Malva parviflora* (Shapiro 1974b), *Malva sylvestris* (Shapiro 1974b), *Malva verticillata* (Klassen et al. 1989), *Malva* species (Scudder 1889a,b), *Malvastrum americanum* (ROK collection), *Malvastrum coromandelianum* (Scott 1986), *Malvastrum rotundifolium* (Scott 1986), *Modiola caroliniana* (Scott 1986), *Sida filicaulis* (Kendall 1965), *Sida hederacea* (Shapiro 1974b,c), *Sida lindheimeri* (Kendall 1965), *Sida rhombifolia* (Kendall 1965), *Sida spinosa* (Comstock 1940), *Sidalcea glaucescens* (Emmel and Emmel 1962), *Sidalcea neomexicana* (Scott and Scott 1980), *Sidalcea oregana* ssp. *spicata* (Shapiro et al. 1981), *Sphaeralcea ambigua* (Austin and Austin 1981), *Sphaeralcea angustifolia* (Kendall 1965), *Sphaeralcea angustifolia* ssp. *cuspidata* (Kendall 1965), *Sphaeralcea*

coccinea (Scott and Scott 1980), *Sphaeralcea digitata* (Hayward 1947), *Sphaeralcea lindheimeri* (Hayward 1947), *Sphaeralcea munroana* (Scott 1986), *Sphaeralcea parvifolia* (Scott 1986).

Specimens Examined. EGGS: OREGON: BENTON CO.: Lot 634, 1 egg (TCE). LARVAE: CALIFORNIA: SACRAMENTO CO.: Lot 15, 3 larvae (instar 5) (MCM). TUOLUMNE CO.: Lot 455, 3 larvae (instars 4, 5) (MCM). YOLO CO.: Lot 453, 7 larvae (instar 5) (MCM); Lot 454, 14 larvae (instars 3, 4, 5) (MCM); Lot 456, 3 larvae (instar 3) (MCM). FLORIDA: ALACHUA CO.: Lot 452, 2 larvae (instar 5) (MCM); Lot 737, 1 larva (instar 5) (MCM); Lot 1283, 1 larva (instar 5) (DHH); Lot 1290, 3 larvae (instars 2, 3) (DHH); Lot 1291, 1 larva (instar 5) (DHH). MISSOURI: BOONE CO.: Lot 1286, 1 larva (instar 5) (DHH). NORTH DAKOTA: CASS CO.: Lot 541, 1 larva (instar 5) (TLM). OREGON: BENTON CO.: Lot 634, 24 larvae (instars 1, 2, 3, 4, 5) (TCE). PUPAE: CALIFORNIA: SACRAMENTO CO.: Lot 15, 2 pupae (MCM). TUOLUMNE CO.: Lot 455, 1 pupa (MCM). YOLO CO.: Lot 453, 6 pupae (MCM). FLORIDA: ALACHUA CO.: Lot 452, 2 pupae (MCM). NORTH DAKOTA: CASS CO.: Lot 541, 2 pupae (TLM). OREGON: BENTON CO.: Lot 634, 3 pupae (TCE).

104. *Pyrgus albescens* Plötz

Diagnosis. LAST INSTAR LARVA: BODY: length 27mm, A4 transverse width 4.2mm; preserved specimen pale; some setae with slightly expanded tips, to 0.3mm long on A4 dorsum;

spiracles tan. HEAD: black; transverse width 2.1-3.1mm; sculpturing rough; mandibles with teeth; setae branching, to 0.2mm long at apex, a few ventral setae to 0.6mm; stemmata subequal (Figure 40V); postocciput moderately wide. THORAX: T1 legs brown, T2 legs tan, T3 legs pale; shield broad, anterior light brown, posterior dark brown. ABDOMEN: prolegs each with about 60 crochets, multiordinal, ca. 2-3 ranks, arranged in a circle.

Other Descriptions. See *P. communis*. Identification of these two species is difficult and their distinction in the literature is not clear.

Host Plants. MALVACEAE: *Abutilon* species (Brown et al. 1992), *Hibiscus* species (Brown et al. 1992), *Malva parviflora* (GRB collection), *Sida hederacea* (Orsak 1978), *Sidalcea* species (Garth 1950), *Sphaeralcea fendleri* (Bailowitz and Brock 1991), *Sphaeralcea laxa* (Bailowitz and Brock 1991).

Specimens Examined. LARVAE: CALIFORNIA: RIVERSIDE CO.: Lot 588, 1 larva (instar 5) (GRB).

105. *Pyrgus oileus* (Linnaeus)

Diagnosis. LAST INSTAR LARVA: BODY: Figure 20C, length 19-24mm, A4 transverse width 3-4.4mm; green with numerous tiny white spots, heart line dark, subdorsal faint, dark, outlined by pale yellow; some setae with slightly expanded tips, to 0.5mm long on A4 dorsum; spiracles tan. HEAD: black; transverse width 2.1-3.1mm; sculpturing rough;

mandibles with teeth; setae feathery, to 0.2mm long at apex, a few ventral setae to 0.6mm; stemmata subequal (Figure 40W); postocciput moderately wide. THORAX: T1 legs brown, T2 legs tan, T3 legs pale; shield broad, brown with pale mesodorsal and later spots. ABDOMEN: prolegs each with about 65 crochets, multiordinal, ca. 2-3 ranks, arranged in a circle. PUPA: Figures 67G and 88E, length 14-17mm, A3 transverse width 3.9-4.5mm; green with dark markings; thoracic spiracle guard distinct; some setae slightly feathery, to 0.8mm long on head; head rounded; antennal tip lies far cephalad of tip of middle leg; proboscis extending to the wing tips; abdomen moderately long; cremaster to 1.3mm long, blunt with numerous hooked setae in a cluster at the tip (Figures 105G and 117B).

Other Descriptions. Panton 1897 (egg, larva, pupa), Swainson 1901 (larva, pupa), Dethier 1940a (egg, young larva), Dethier 1942b (larva, pupa), Moss 1949 (larva), Wolcott 1951 (larva, pupa), Minno and Emmel 1993 (egg, larva, pupa).

Host Plants. MALVACEAE: *Abutilon* species (Tietz 1952), *Althaea rosea* (Tietz 1952), *Hibiscus trionum* (Tietz 1952), *Malva neglecta* (Tietz 1952), *Malvastrum americanum* (Tietz 1952), *Malvastrum corchorifolium* (Minno and Emmel 1993, probably), *Malvastrum coromandelianum* (Tietz 1972), *Sida acuta* (Minno and Emmel 1993, probably), *Sida antillensis* (Wolcott 1923), *Sida carpinifolia* (Wolcott 1923), *Sida*

retusa (Grossbeck 1917), *Sida rhombifolia* (Bottimer 1926), *Sida salviaefolia* (Kendall 1976), *Sida spinosa* (Tietz 1952), *Sidalcea humilis* (Tietz 1952), *Sidalcea malvaeflora* (Tietz 1972).

Specimens Examined. DOMINICAN REPUBLIC: LA VEGA PROV.:

Lot 461, 1 larva (instar 5) (MCM). PUERTO PLATA PROV.: Lot 462, 1 larva (instar 5) (MCM). FLORIDA: ALACHUA CO.: Lot 736, 1 larva (instar 5) (MCM); Lot 1284, 1 larva (instar 5) (DHH); Lot 1285, 1 larva (instar 3) (DHH); Lot 1495, 1 larva (instar 5) (DHH). BROWARD CO.: Lot 459, 2 larvae (instar 5) (MCM). PUPAE: DOMINICAN REPUBLIC: LA VEGA PROV.: Lot 461, 1 pupa (MCM). FLORIDA: BROWARD CO.: Lot 459, 4 pupae (MCM).

106. *Pyrgus philetas* Edwards

The immature stages of this species have not been described, but the larvae feed on malvaceous plants such as *Sida procumbens* and probably *Sida spinosa* (Bailowitz and Brock 1991).

107. *Helioptetes domicella* (Erichson)

The immature stages of this species have not been described, but the larvae feed on malvaceous plants such as *Abutilon incanum* and *Herissantia crispa* (Bailowitz and Brock 1991).

108. *Helioptetes ericetorum* (Boisduval)

Diagnosis. LAST INSTAR LARVA: BODY: length 22-31mm, A4 transverse width 3.9-6.4mm; green, heart line dark; some

setae with blunt or slightly expanded tips, to 0.4mm long on A4 dorsum; spiracles tan. HEAD: Figure 28B, black; transverse width 2.3-3.4mm; sculpturing rough; mandibles with teeth; setae feathery, to 0.3mm long at apex, a few ventral setae to 0.6mm; stemmata subequal (Figure 40X); postocciput moderately wide. THORAX: T1 legs dark brown, T2-3 legs tan to pale; shield indistinct. ABDOMEN: prolegs each with about 35 crochets, irregularly biordinal, arranged in a mesal penellipse; suranal plate rounded, unmarked (Figure 49A). PUPA: Figures 67H and 88F, length 15-20mm, A3 transverse width 4.4-5.2mm; light brown with dark spots; thoracic spiracle guard distinct; setae simple, to 0.8mm long on head; head rounded; antennal tip lies far cephalad of tip of middle leg; proboscis extending to the wing tips; abdomen moderately long; cremaster to 1.5mm long, blunt with numerous hooked setae in a cluster at the tip (Figures 105H and 117C).

Other Descriptions. Coolidge 1923 (egg, larva, pupa), Comstock 1927b (egg, larva, pupa), Emmel and Emmel 1973 (egg, larva, pupa).

Host Plants. AMARANTHACEAE: *Amaranthus graecizans* (Coolidge 1923) [erroneous], *Amaranthus* species (Comstock 1927b) [erroneous]. MALVACEAE: *Althaea rosea* (Tietz 1972), *Althaea* species (Coolidge 1923), *Eremalche rotundifolia* (Garth and Tilden 1986), *Hibiscus denudatus* (Scott 1986), *Iliamna rivularis* (Newcomer 1964), *Malacothamnus davidsonii*

(Coolidge 1923), *Malacothamnus fasciculatus* (Wright 1905), *Malacothamnus fremontii* ssp. *cercophorum* (Scott 1986), *Malacothamnus orbiculatus* (Coolidge 1923), *Malva nicaeensis* (Coolidge 1923), *Malvastrum exile* (Coolidge 1923), *Malvastrum rotundifolium* (Coolidge 1923), *Sphaeralcea ambigua* (Coolidge 1923), *Sphaeralcea angustifolia* ssp. *cuspidata* (Coolidge 1923), *Sphaeralcea grossulariaefolia* var. *pedata* (Austin and Austin 1981), *Sphaeralcea munroana* (Scott 1986). STERCULIACEAE: (Bailowitz and Brock 1991), *Fremontia californica* (TCE collection).

Specimens Examined. LARVAE: CALIFORNIA: CONTRA COSTA CO.: Lot 246, 7 larvae (instar 5) (MCM). LOS ANGELES CO.: Lot 635, 6 larvae (instars 3, 4, 5) (TCE). RIVERSIDE CO.: Lot 585, 2 larvae (instar 5) (GRB). PUPAE: CALIFORNIA: CONTRA COSTA CO.: Lot 246, 1 pupa (MCM). LOS ANGELES CO.: Lot 635, 2 pupae (TCE).

109. *Helioptetes lavianus* (Hewitson)

Diagnosis. EGG: height 1mm, width 0.7mm, with about 35 vertical rows of short spines. LAST INSTAR LARVA: BODY: length 21-25mm, A4 transverse width 3.8-5.3mm; preserved specimens pale; some setae with slightly expanded tips, to 0.5mm long on A4 dorsum; spiracles pale. HEAD: black; transverse width 2.3-3.4mm; sculpturing rough; mandibles with teeth; setae feathery, to 0.3mm long at apex, a few ventral setae to 0.8mm; stemmata subequal (Figure 40Y); postocciput moderately wide. THORAX: T1 legs brown, T2

legs tan, T3 legs tan to pale; shield broad, light brown with a dark brown border. ABDOMEN: prolegs each with about 50 crochets, irregularly biordinal, arranged in a circle or near circle. PUPA: Figures 68A and 88G, length 16-19mm, A3 transverse width 5.2-5.4mm; light brown with dark spots; thoracic spiracle guard distinct; setae simple, to 0.4mm long on head; head rounded; antennal tip lies far cephalad of tip of middle leg; proboscis extending to the wing tips; abdomen moderately long; cremaster to 1.8mm long, blunt with numerous hooked setae in a cluster at the tip (Figures 105I and 117D).

Host Plants. CONVOLVULACEAE: *Ipomoea* species (da Costa Lima 1936) [erroneous]. MALVACEAE: *Abutilon abutiloides* (Kendall 1965), *Abutilon hypoleucum* (Hayward 1947), *Abutilon incanum* (Kendall 1965, in lab), *Abutilon lignosum* (Scott 1986), *Malvastrum americanum* (Kendall 1965), *Pseudabutilon lozani* (Hayward 1947), *Sida filipes* (Kendall 1965), *Sida hederacea* (Garth and Tilden 1986), *Sphaeralcea* species (Garth and Tilden 1986), *Wissadula holosericea* (Kendall 1965, in lab).

Specimens Examined. EGGS: TEXAS: SAN PATRICIO CO.: Lot 943, 6 eggs (ROK). LARVAE: TEXAS: SAN PATRICIO CO.: Lot 560, 3 larvae (instars 4, 5) (JRH); Lot 943, 6 larvae (instars 3, 5) (ROK). PUPAE: TEXAS: SAN PATRICIO CO.: Lot 560, 1 pupa (JRH); Lot 943, 2 pupae (ROK).

110. *Helioptetes macaira* (Reakirt)

Diagnosis. EGG: height 0.8mm, width 0.6mm, with about 35 vertical rows of short spines. LAST INSTAR LARVA: BODY: length 9-17.5mm, A4 transverse width 2.8-3.6mm; preserved specimens pale; some setae with slightly expanded tips, to 0.7mm long on A4 dorsum; spiracles pale. HEAD: brown, posterior dark brown; transverse width 2.8-3.2mm; sculpturing rough; mandibles with teeth; setae feathery, to 0.4mm long at apex, a few ventral setae to 0.8mm; stemmata subequal (Figure 40Z); postocciput moderately wide. THORAX: legs tan; shield indistinct or broad, tan. ABDOMEN: prolegs each with about 30 crochets, irregularly biordinal, arranged in a circle or near circle.

Host Plants. MALVACEAE: *Malvaviscus drummondii* (Kendall 1965).

Specimens Examined. EGGS: TEXAS: SAN PATRICIO CO.: Lot 944, 6 eggs (ROK). LARVAE: TEXAS: SAN PATRICIO CO.: Lot 944, 10 larvae (instars 1, 2, 5) (ROK).

111. *Helioptetes arsalte* (Linnaeus)

Diagnosis. LAST INSTAR LARVA: BODY: length 30-30.5mm, A4 transverse width 4.3-4.4mm; green, heart line dark; some setae with slightly expanded tips, to 0.9mm long on A4 dorsum; spiracles tan. HEAD: black; transverse width 2.9-3mm; sculpturing rough; mandibles with teeth; setae slightly feathery, to 0.3mm long at apex, a few ventral setae to 0.8mm; stemmata subequal (Figure 40AA); postocciput

moderately wide. THORAX: legs tan; shield indistinct or broad, tan. ABDOMEN: prolegs each with about 50 crochets, irregularly biordinal, arranged in a circle or near circle.

Host Plants. MALVACEAE: *Sida* species (MCM collection).

Specimens Examined. LARVAE: COLOMBIA: DEPT. VALLE DEL CAUCA: Lot 244, 1 larva (instar 5) (MCM); Lot 245, 2 larvae (instars 4, 5) (MCM).

112. *Celotes nessus* (Edwards)

Diagnosis. EGG: height 0.8mm, width 0.5-0.6mm, with 36-38 vertical rows of short spines. LAST INSTAR LARVA: BODY: length 13.5-23.5mm, A4 transverse width 3.5-4.4mm; preserved specimens pale; some setae with slightly expanded tips, to 0.4mm long on A4 dorsum; spiracles pale. HEAD: Figure 28C, black; transverse width 2.6-3.1mm; sculpturing rough; mandibles with some small, rounded teeth; setae feathery, to 0.2mm long at apex, a few ventral setae to 0.5mm; stemmata subequal (Figure 40BB); postocciput moderately wide.

THORAX: legs pale; shield indistinct. ABDOMEN: prolegs each with about 30 crochets, irregularly biordinal, arranged in mesal penellipse; suranal plate rounded, unmarked (Figure 49B). PUPA: Figures 68B and 88H, length 12-15mm, A3 transverse width 3.8-4.6mm; light brown with dark spots; thoracic spiracle guard distinct; setae simple, to 0.4mm long on head; head rounded; antennal tip lies far cephalad of tip of middle leg; proboscis extending to the wing tips; abdomen short; cremaster to 1.1mm long, blunt with numerous

hooked setae in a cluster at the tip (Figures 105J and 117E).

Host Plants. MALVACEAE: *Abutilon incanum* (Kendall 1960), *Althaea rosea* (Kendall 1965), *Sida filipes* (Kendall 1965), *Sphaeralcea angustifolia* var. *lobata* (Kendall 1965), *Wissadula amplissima* (Kendall 1965), *Wissadula holosericea* (Burns 1964b). STERCULIACEAE: *Ayenia compacta* (Bailowitz and Brock 1991).

Specimens Examined. EGGS: TEXAS: BEXAR CO.: Lot 920, 5 eggs (ROK). LARVAE: TEXAS: BEXAR CO.: Lot 920, 8 larvae (instar 5) (ROK). PUPAE: TEXAS: BEXAR CO.: Lot 920, 6 pupae (ROK).

113. *Celotes limpia* Burns

Diagnosis. EGG: height 1.1mm, width 0.6-0.7mm, with about 37-45 vertical rows of short spines. LAST INSTAR LARVA: BODY: length 17-18mm, A4 transverse width 3.8-4mm; preserved specimens pale; some setae with slightly expanded tips, to 0.4mm long on A4 dorsum; spiracles tan. HEAD: black; transverse width 2.7-2.8mm; sculpturing rough; mandibles with some small, rounded teeth; setae feathery, to 0.2mm long at apex, a few ventral setae to 0.4mm; stemmata subequal (Figure 40CC); postocciput moderately wide. THORAX: legs pale; shield indistinct. ABDOMEN: prolegs each with about 30 crochets, irregularly biordinal, arranged in mesal penellipse. PUPA: length 12-15mm, A3 transverse width 3.8-4.6mm; light brown with dark spots; thoracic

spiracle guard distinct; setae simple, to 0.4mm long on head; head rounded; antennal tip lies far cephalad of tip of middle leg; proboscis extending to the wing tips; abdomen short; cremaster to 1.1mm long, blunt with numerous hooked setae in a cluster at the tip.

Host Plants. MALVACEAE: *Abutilon incanum* (Burns 1964b), *Abutilon malacum* (Burns 1964b), *Althaea rosea* (Burns 1964b, in lab), *Malvastrum americanum* (Burns 1964b, in lab), *Sphaeralcea angustifolia* var. *lobata* (Burns 1964b), *Wissadula holosericea* (Burns 1964b).

Specimens Examined. EGGS: TEXAS: JEFF DAVIS CO.: Lot 919, 5 eggs (ROK). LARVAE: TEXAS: JEFF DAVIS CO.: Lot 919, 3 larvae (instar 5) (ROK).

114. *Pholisora catullus* (Fabricius)

Diagnosis. LAST INSTAR LARVA: BODY: Figure 20B, length 12-21.5mm, A4 transverse width 2.4-4.9mm; green with numerous tiny white spots, heart line dark, subdorsal narrow, dark, outlined with pale yellow; some setae with slightly expanded tips, to 0.3mm long on A4 dorsum; spiracles tan. HEAD: Figure 28D, black; transverse width 2.4-3.1mm; sculpturing rough; mandibles with teeth; setae feathery, to 0.2mm long at apex, a few ventral setae to 0.5mm; stemmata subequal (Figure 40DD); postocciput moderately wide. THORAX: legs pale to tan; shield moderately wide, a dark brown band between the annuli. ABDOMEN: prolegs each with about 45 crochets, irregularly

biordinal, arranged in mesal penellipse; suranal plate rounded, unmarked (Figure 49C). PUPA: Figures 68C and 89A, length 12-14mm, A3 transverse width 3.8-4.7mm; light brown; thoracic spiracle guard distinct; setae simple, to 0.4mm long on head; head rounded; antennal tip lies slightly cephalad of tip of middle leg; proboscis extending to the wing tips; abdomen short; cremaster to 0.7mm long, constricted, blunt with numerous hooked setae in a cluster at the tip (Figures 105K and 117F).

Other Descriptions. Scudder 1889a (egg, larva, pupa), Edwards 1885b (egg, larva, pupa), Comstock 1927b (egg, larva, pupa), Comstock and Dammers 1935 (egg), Emmel and Emmel 1973 (egg, larva, pupa), Capman 1990 (egg, larva).

Host Plants. AMARANTHACEAE: *Amaranthus albus* (Scudder 1889a,b), *Amaranthus caudatus* (Kendall 1965), *Amaranthus graecizans* (Klots 1951), *Amaranthus hybridus* (Kendall 1965), *Amaranthus retroflexus* (Kendall 1965), *Amaranthus spinosus* (Kendall 1965), *Amaranthus* species (Scudder 1872), *Celosia argentea* var. *cristata* (Shapiro 1968). ASTERACEAE: *Ambrosia* species (Scudder 1881) [erroneous].

CAPRIFOLIACEAE: *Symporicarpos rivularis* (Tietz 1952) [erroneous], *Symporicarpos* species (Comstock 1927b) [erroneous].

CHENOPODIACEAE: *Atriplex rosea* (Shapiro 1974b), *Chenopodium album* (Scudder 1872), *Chenopodium ambrosioides* (Kendall 1965), *Chenopodium berlandieri* (Kendall 1965), *Chenopodium foliosum* (Scott 1986),

Chenopodium murale (Shapiro 1974b), *Chenopodium paganum* (Shapiro 1968). LAMIACEAE: *Marrubium* species (Shapiro 1966) [erroneous], *Mentha* species (Shapiro 1966, possibly) [erroneous], *Monarda punctata* (Scudder 1872) [erroneous], *Origanum vulgare* (Edwards 1885b) [erroneous]. MALVACEAE: *Malva neglecta* (Newcomer 1964) [erroneous]. POACEAE: *Saccharum officinarum* (Bodkin 1913) [erroneous], *Zea mays* (Mather and Mather 1958) [erroneous].

Specimens Examined. LARVAE: CALIFORNIA: SAN BERNARDINO CO.: Lot 581, 1 larva (instar 5) (GRB). YOLO CO.: Lot 368, 3 larvae (instars 3, 5) (MCM); Lot 370, 3 larvae (instar 5) (MCM); Lot 371, 2 larvae (instar 5) (MCM). FLORIDA: ALACHUA CO.: Lot 1266, 1 larva (instar 5) (DHH). ILLINOIS: Lot 616, 7 larvae (instars 4, 5) (SP). INDIANA: TIPPECANOE CO.: Lot 367, 2 larvae (instars 3, 5) (MCM). KANSAS: DOUGLAS CO.: Lot 637, 1 larva (instar 5) (TCE). MARYLAND: PRINCE GEORGE'S CO.: Lot 1, 4 larvae (instars 3, 4, 5) (MCM); Lot 369, 1 larva (instar 5) (MCM). MISSOURI: BOONE CO.: Lot 1267, 1 larva (instar 5) (DHH); Lot 1269, 1 larva (instar 5) (DHH). Lot 1270, 3 larvae (instar 5) (DHH). NORTH DAKOTA: CASS CO.: Lot 539, 2 larvae (instar 5) (TLM). SOUTH CAROLINA: NEWBERRY CO.: Lot 1271, 3 larvae (instar 1) (DHH). TEXAS: WICHITA CO.: Lot 366, 5 larvae (instar 5) (MCM). PUPAE: CALIFORNIA: YOLO CO.: Lot 368, 8 pupa (MCM). ILLINOIS: Lot 616, 1 pupa (SP). TEXAS: WICHITA CO.: Lot 366, 1 pupa (MCM).

115. *Pholisora mejicana* (Reakirt)

I could not locate immatures of this southwestern species for study, but Scott (1986) has briefly described the egg, larva, and pupa.

Host Plants. AMARANTHACEAE: *Amaranthus graecizans* (Stanford 1981), *Amaranthus retroflexus* (Scott and Scott 1980). CHENOPodiACEAE: *Chenopodium album* (Scott and Scott 1980, in lab), *Chenopodium* species (Scott and Scott 1980).

116. *Pholisora libya* (Scudder)

I could not locate immatures of this southwestern species for study, but Comstock and Dammers (1932b) and Emmel and Emmel (1973) have described the immature stages.

Host Plants. CHENOPodiACEAE: *Atriplex canescens* (Comstock and Dammers 1932b; McCabe and Post 1977), *Atriplex confertifolia* (Scott 1986, associated with).

117. *Pholisora alpheus* (Edwards)

Diagnosis. LAST INSTAR LARVA: BODY: length 12-28.5mm, A4 transverse width 2.6-4.9mm; preserved specimens pale; some setae with slightly expanded tips, to 0.1mm long on A4 dorsum; spiracles tan. HEAD: black; transverse width 2.2-3mm; sculpturing rough; mandibles with teeth; setae feathery, to 0.3mm long at apex, a few ventral setae to 0.6mm; stemmata subequal (Figure 41A); postocciput moderately wide. THORAX: legs pale; shield indistinct. ABDOMEN: prolegs each with about 40 crochets, irregularly biordinal, arranged in mesal penellipse. PUPA: Figures 68D

and 89B, length 12mm, A3 transverse width 3.8mm; light brown with dark spots; thoracic spiracle guard distinct; setae simple, to 0.5mm long on head; head rounded; antennal tip lies far cephalad of tip of middle leg; proboscis extending to the wing tips; abdomen short; cremaster to 0.7mm long, constricted, blunt with numerous hooked setae in a cluster at the tip (Figures 105L and 117G).

Host Plants. CHENOPODIACEAE: *Atriplex argentea* var. *expansa* (Davenport and Dethier 1938), *Atriplex canescens* (MacNeill 1970).

Specimens Examined. EGGS: TEXAS: BREWSTER CO.: Lot 963, 1 egg (ROK). LARVAE: TEXAS: BREWSTER CO.: Lot 963, 1 larva (instar 5) (ROK). CAMERON CO.: Lot 558, 6 larvae (instars 3, 4, 5) (JRH). CALIFORNIA: KERN CO.: Lot 593, 2 larvae (instar 5) (GRB).

118. *Pholisor graciella* MacNeill

Diagnosis. LAST INSTAR LARVA: BODY: length 21mm, A4 transverse width 3.9mm; preserved specimens pale; some setae with slightly expanded tips, < 0.1mm long on A4 dorsum; spiracles tan. HEAD: black; transverse width 2.3mm; sculpturing rough; mandibles with teeth; setae feathery, to 0.3mm long at apex, a few ventral setae to 0.4mm; stemmata subequal (Figure 41B); postocciput moderately wide. THORAX: legs pale; shield indistinct. ABDOMEN: prolegs each with about 35 crochets, irregularly triordinal, arranged in mesal penellipse.

Other Descriptions. Comstock 1929 (egg, larva, pupa), Emmel and Emmel 1973 (egg, larva, pupa).

Host Plants. CHENOPODIACEAE: *Atriplex argentea* var. *expansa* (Comstock 1929), *Atriplex canescens* (Scott 1986, associated with), *Atriplex lentiformis* (MacNeill 1970), *Chenopodium* species (Scott 1986).

Specimens Examined. LARVAE: CALIFORNIA: SAN BERNARDINO CO.: Lot 1498, 1 larva (instar 5) (GRB).

Subfamily Heteropterinae

Too few specimens were available to provide an adequate diagnosis of this subfamily.

119. *Carterocephalus palaemon* (Pallas)

No preserved eggs, mature larvae, or pupae of this boreal species were available for study.

Other Descriptions. Fletcher 1888, 1889 (egg, larva), Frohawk 1892 (egg, larva, pupa).

Host Plants. POACEAE: *Agropyron repens* (Fletcher 1889, in lab), *Bromus asper* (Frowawk 1892, in lab), *Bromus ciliatus* var. *asper* (Tietz 1972), *Calamagrostis purpurascens* (MacNeill 1975), *Digitaria sanguinalis* (Fletcher 1889, in lab), *Echinochloa crusgalli* (Fletcher 1889, in lab), *Panicum* species (Forbes 1960), *Poa pratensis* (Fletcher 1888, in lab).

Specimens Examined. LARVAE: CALIFORNIA: SIERRA CO.: Lot 123, 6 larvae (instar 1) (MCM).

120. *Piruna pirus* (Edwards)

Diagnosis. LAST INSTAR LARVA: BODY: length 12-25mm, A4 transverse width 3.4-3.8mm; preserved specimens pale; setae simple, to 0.1mm long on A4 dorsum; spiracles tan. HEAD: Figure 28E, pale with brown medial and lateral stripes, front with a few brown stripes, postocciput dark brown, transverse width 2.3-2.5mm; sculpturing rough; setae simple, < 0.1mm long at apex, a few ventral setae to 0.4mm; stemmata 5 and 6 relatively small (Figure 41C); paraclypeal hooks present. THORAX: legs pale; shield a narrow dark brown band between the annuli. ABDOMEN: prolegs each with about 70 crochets, irregularly triordinal, arranged in a circle; suranal plate rounded, unmarked (Figure 49D).

Host Plants. POACEAE: *Lolium* species (ROK collection, in lab), *Poa* species (Scott and Scott 1980, probably).

Specimens Examined. LARVAE: MEXICO: NUEVO LEON: Lot 965, 4 larvae (instar 5) (ROK).

121. *Piruna polingii* (Barnes)

Nothing is known of the biology of this southwestern species, except that the grass, *Dactylis glomerata*, may be a host (Bailowitz and Brock 1991).

122. *Piruna microstictus* (Godman)

Nothing is known of the biology of this southwestern species.

123. *Piruna haferniki* H. A. Freeman

Nothing is known of the biology of this southwestern species.

Subfamily Hesperiinae

Diagnosis. EGG: with polygonal sculpturing, usually pale green or white, occasionally pink, gray, or brownish, sometimes with a red ring, height 0.4-1.2mm, width 0.6-1.6mm. LAST INSTAR LARVA: BODY: length 9.8-63mm, A4 transverse width 1.6-9.5mm; setae usually simple, < 0.1-1.3mm long; spiracles pale to dark, T1 and A8 spiracles largest. HEAD: pale, dark, or patterned; transverse width 1.5-4.4mm; sculpturing rough to pitted; mandibles without teeth, hesperiine type articulation; labial-submental complex relatively small; setae simple, < 0.1-1.8mm long; stemmata usually subequal, 5 or 6 sometimes small; postocciput narrow. THORAX: prothorax about the same size as head or smaller; legs pale to black; shield narrow to broad; ventral prothoracic gland present. ABDOMEN: A4 proleg with 50-230 crochets, more or less triordinal, arranged in a circle, a near circle, or a mesal penellipse, posterior prolegs always with a mesal penellipse; suranal plate usually rounded, sometimes pointed, occasionally with dark markings; anal comb well developed; wax glands sometimes present in the form of longitudinal or transverse patches or spots on the ventral side of A1, A3-6, or A7-8. PUPA: length 12.5-43.5mm, A3 transverse width 2.1-8.5mm;

green or brown; thoracic spiracle guard distinct; setae < 0.1-0.8mm; pilifers separated; head usually rounded, occasionally with a long pointed process on cap; antennal tip lies far cephalad of tip of middle leg; proboscis extending into A5 to beyond the body; abdomen moderately long or long; cremaster bluntly pointed or rounded, hooked setae sometimes absent; lenticles present on the prothorax, dorsal abdomen, and proleg scars.

124. *Synapte malitiosa* (Herrich-Schäffer)

Diagnosis. LAST INSTAR LARVA: BODY: length 20.5-21.5mm, A4 transverse width 3-3.6mm; green frosted with tiny white spots, heart line, subdorsal, and lateral lines dark green (unfrosted); setae simple, to 0.1mm long on A4 dorsum; spiracles tan. HEAD: Figure 28F, rounded, pale, medial line dark brown along adfrontals, light brown at vertex, lateral line dark brown, front with a few dark brown stripes, postocciput black; transverse width 2.2-2.3mm; sculpturing rough; setae simple, < 0.1mm long at apex, a few ventral setae to 0.2mm; stemmata subequal (Figure 41D).

THORAX: legs pale or tan; shield a very narrow dark brown band between the annuli. ABDOMEN: prolegs with about 130 crochets, irregularly triordinal, arranged in a circle; suranal plate rounded, unmarked (Figure 49E); wax glands broad, transverse patches posterior of prolegs on A3-A6 (Figure 15C). PUPA: Figures 59F, 68E, and 89C, length 16-16.5mm, A3 transverse width 3-4.8mm; cream-colored; setae

simple, to 0.6mm long on head; thoracic spiracle guard distinct; pilifers separated; head with a short, mesal process on cap; antennal tip lies slightly cephalad of tip of middle leg; proboscis extending to the cremaster; abdomen moderately long; cremaster to 1.8mm long, bluntly pointed with numerous hooked setae in a cluster at the tip (Figures 105M and 117H); lenticles present on the proleg scars.

Host Plants. POACEAE: *Panicum maximum* (Kendall 1976), *Paspalum* species (Scott 1986).

Specimens Examined. LARVAE: DOMINICAN REPUBLIC: LA VEGA PROV.: Lot 470, 1 larva (instar 5) (MCM); Lot 471, 2 larvae (instars 4, 5) (MCM). PUPAE: DOMINICAN REPUBLIC: LA VEGA PROV.: Lot 471, 4 pupae (MCM).

125. *Synapte salenus* (Mabille)

Nothing is known of the biology of this neotropical species.

126. *Corticea corticea* (Plötz)

The immature stages of this common neotropical species are undescribed and I could not locate specimens for study.

Host Plants. POACEAE: *Saccharum officinarum* (Moss 1949).

127. *Callimormus saturnus* (Herrich-Schäffer)

Nothing is known of the biology of this species from tropical America.

128. *Vidius perigenes* (Godman)

Diagnosis. LAST INSTAR LARVA: BODY: length 26mm, A4 transverse width 3.2mm; preserved specimen pale, frosted

with tiny white spots, heart, subdorsal, and lateral lines unfrosted; setae simple, to 0.2mm long on A4 dorsum; spiracles tan. HEAD: Figure 28G, pale, medial and epicranial lines convergent at midadfrontals, brown, lateral line and postocciput dark brown, frontal sclerite with a few brown lines; transverse width 2.6mm; setae simple, to 0.1mm long at apex, a few ventral setae to 0.4mm; stemma 6 small (Figure 41E). THORAX: legs pale to tan; shield a narrow black line between the annuli. ABDOMEN: prolegs each with about 130 crochets, irregularly triordinal, arranged in a circle or near circle; suranal plate rounded, unmarked (Figure 49F).

Host Plants. POACAEAE: *Spartina spartinae* (ROK collection), *Stenotaphrum secundatum* (Kendall 1966a, in lab).

Specimens Examined. LARVAE: TEXAS: CAMERON CO.: Lot 989, 4 larvae (instars 3, 4, 5) (ROK).

129. *Monca tyrtaeus* (Plötz)

Nothing is known of the biology of this neotropical species.

130. *Nastra lherminier* (Latreille)

Diagnosis. LAST INSTAR LARVA: BODY: length 22-26mm, A4 transverse width 2.8-3.3mm; green with a yellowish cast, heart line dark green, subdorsal line narrow, faint, yellowish; setae simple, < 0.1mm long on A4 dorsum; spiracles tan. HEAD: Figure 28H, pale, medial and

epicranial lines separate, reddish, lateral line reddish (These markings often fade on preserved specimens.); transverse width 1.8-2.1mm; sculpturing rough; setae simple, < 0.1mm long at apex, a few ventral setae to 0.2mm; stemma 6 small (Figure 41F). THORAX: legs pale; shield indistinct. ABDOMEN: prolegs each with about 85 crochets, irregularly triordinal, arranged in a circle or near circle; suranal plate rounded, unmarked (Figure 49G). PUPA: Figures 60A, 68F, and 89D, length 20.5mm, A3 transverse width 3.3-3.4mm; pale green, heart line darker green, faintly outlined with white, subdorsal and lateral lines outlined with faint white bands; thoracic spiracle guard indistinct; setae simple, < 0.1mm long on head; pilifers nearly touching; head with a long pointed process on cap; antennal tip lies cephalad of tip of middle leg; proboscis extending into A7; abdomen long; cremaster to 1.9mm long, blunt with numerous hooked setae in a cluster at the tip (Figures 105N and 117I); lenticles present on the proleg scars.

Other Descriptions. Laurent 1908 (egg, young larva).

Host Plants. POACEAE: *Andropogon scoparius* (Shapiro 1966), *Andropogon* species (MCM collection).

Specimens Examined. LARVAE: GEORGIA: HARRIS CO.: Lot 330, 4 larvae (instar 5) (MCM). MARYLAND: PRINCE GEORGE'S CO.: Lot 331, 4 larvae (instars 3, 4, 5) (MCM). PUPAE: GEORGIA: HARRIS CO.: Lot 330, 1 pupa (MCM). MARYLAND: PRINCE GEORGE'S CO.: Lot 331, 2 pupae (MCM).

131. *Nastraea julia* (H. A. Freeman)

Diagnosis. LAST INSTAR LARVA: BODY: length 26-27mm, A4 transverse width 3.3-3.5mm; preserved specimens pale; setae simple, < 0.1mm long on A4 dorsum; spiracles tan. HEAD: pale, medial and epicranial lines separate, reddish, lateral line reddish; transverse width 1.9-2.3mm; setae simple, < 0.1mm long at apex, a few ventral setae to 0.2mm; stemma 6 small (Figure 41G). THORAX: legs pale; shield indistinct. ABDOMEN: prolegs with about 80 crochets, irregularly triordinal, arranged in a circle; suranal plate rounded, unmarked. PUPA: Figures 68G and 89E, length 19mm, A3 transverse width 3.6mm; pale; thoracic spiracle guard indistinct; setae simple, < 0.1mm long on head; pilifers touching; head with a long pointed process on cap; antennal tip lies cephalad of tip of middle leg; proboscis extending into A8; abdomen long; cremaster to 1.8mm long, blunt with numerous hooked setae in a cluster at the tip (Figures 1050 and 117J); lenticles indistinct.

Host Plants. POACEAE: *Cynodon dactylon* (Scott 1986), *Sorghum sudanense* (USNM collection), *Stenotaphrum secundatum* (Kendall 1960, in lab).

Specimens Examined. LARVAE: TEXAS: BEXAR CO.: Lot 951, 1 larva (instar 5) (ROK). MAVERICK CO.: Lot 774, 1 larva (instar 5) (USNM). PUPAE: TEXAS: BEXAR CO.: Lot 951, 1 pupa (ROK).

132. *Nastra neamathea* (Skinner and R. C. Williams)

Diagnosis. LAST INSTAR LARVA: BODY: length 13-26.5mm, A4 transverse width 2.3-3.5mm; green with a yellowish cast, heart line darker green, subdorsal line narrow, faint, yellowish; setae simple, < 0.1mm long on A4 dorsum; spiracles tan. HEAD: pale, medial and epicranial lines separate, reddish, lateral line reddish; transverse width 2-2.4mm; setae simple, < 0.1mm long at apex, a few ventral setae to 0.1mm; stemma 6 small (Figure 41H). THORAX: legs pale; shield indistinct. ABDOMEN: prolegs each with about 85 crochets, irregularly triordinal, arranged in a circle; suranal plate rounded, unmarked. PUPA: Figures 68H and 89F, length 19-19.5mm, A3 transverse width 3.2mm; pale green, heart line darker green, faintly outlined with white; thoracic spiracle guard indistinct; setae simple, < 0.1mm long on head; pilifers touching; head with a long pointed process on cap; antennal tip lies cephalad of tip of middle leg; proboscis extending to the cremaster; abdomen long; cremaster to 1.8mm long, blunt with numerous hooked setae in a cluster at the tip (Figures 105P and 117K); lenticles indistinct.

Other Descriptions. Minno and Emmel 1993 (larva, pupa).

Host Plants. POACEAE: *Andropogon virginicus* var. *glaucus* (MCM observation, probably for *N. neamathea*), *Andropogon* species (Minno and Emmel 1993), *Sorghum halepense* (ROK collection).

Specimens Examined. LARVAE: TEXAS: LEON CO.: Lot 952, 1 larva (instar 5) (ROK). *Nastra* species, probably *N. neamathea*: FLORIDA: ALACHUA CO.: Lot 1067, 1 larva (instar 4) (DHH). DUVAL CO.: Lot 334, 2 larvae (instar 3) (MCM); Lot 337, 2 larvae (instar 5) (MCM); Lot 701, 1 larva (instar 5) (MCM); Lot 703, 1 larva (instar 5) (MCM). PUTNAM CO.: Lot 332, 6 larvae (instar 5) (MCM); Lot 338, 1 larva (instar 4) (MCM). ST. JOHNS CO.: Lot 335, 1 larva (instar 5) (MCM). VOLUSIA CO.: Lot 336, 1 larva (instar 5) (MCM); Lot 702, 1 larva (instar 5) (MCM); Lot 1066, 1 larva (instar 5) (DHH). PUPAE: *Nastra* species, probably *N. neamathea*: FLORIDA: DUVAL CO.: Lot 333, 1 pupa (MCM). PUTNAM CO.: Lot 332, 2 pupae (MCM).

133. *Cymaenes tripunctus* (Herrich-Schäffer)

Diagnosis. LAST INSTAR LARVA: BODY: length 19-29mm, A4 transverse width 2.5-3.8mm; green, lightly frosted with white, heart line darker green, lateral line narrow, green outlined by faint white lines; setae simple, to 0.2mm long on A4 dorsum; spiracles tan. HEAD: Figure 29A, pale, medial and epicranial lines broadly convergent along the adfrontals, dark brown, front mostly pale, lateral line and postocciput dark brown; transverse width 2-2.4mm; setae simple, < 0.1mm long at apex, a few ventral setae to 0.3mm; stemma 6 very small (Figure 41I). THORAX: legs pale; shield indistinct. ABDOMEN: prolegs each with about 100 crochets, irregularly triordinal, arranged in a near circle;

suranal plate rounded, unmarked (Figure 50A). PUPA: Figures 59E, 69A, and 89G, length 15.5-21mm, A3 transverse width 2.5-3.6mm; pale green, heart line darker green outlined with white; thoracic spiracle guard indistinct; setae simple, < 0.1mm long on head; pilifers nearly touching; head with a long pointed process on cap; antennal tip lies slightly cephalad of tip of middle leg; proboscis extending to the cremaster; abdomen long; cremaster to 1.8mm long, blunt with numerous hooked setae in a cluster at the tip (Figures 106A and 117L); lenticles present on the prothorax and proleg scars.

Other Descriptions. Dethier 1939b, 1942d (egg, larva, pupa), Peterson 1962 (larva), Minno and Emmel 1993 (larva, pupa).

Host Plants. POACEAE: *Bambusa vulgaris* (Bruner et al. 1945), *Brachiaria mutica* (MCM collection), *Digitaria sanguinalis* (Minno and Emmel 1993), *Panicum maximum* (Comstock 1944), *Paspalum setaceum* (MCM collection), *Saccharum officinarum* (Dethier 1939b, in lab), *Tripsacum dactyloides* (MCM observation).

Specimens Examined. LARVAE: DOMINICAN REPUBLIC: LA VEGA PROV.: Lot 134, 3 larvae (instar 5) (MCM); Lot 136, 6 larvae (instars 2, 5) (MCM). PUERTO PLATA PROV.: Lot 135, 4 larvae (instars 4, 5) (MCM). SANTIAGO PROV.: Lot 133, 1 larva (instar 5) (MCM). FLORIDA: BROWARD CO.: Lot 129, 1 larva (instar 5) (MCM); Lot 131, 3 larvae (instar 5) (MCM);

Lot 132, 1 larva (instar 5). MONROE CO.: Lot 128, 8 larvae (instar 5) (MCM); Lot 130, 4 larvae (instar 5) (MCM); Lot 665, 1 larva (instar 5) (MCM). PUPAE: DOMINICAN REPUBLIC: LA VEGA PROV.: Lot 136, 3 pupae (MCM). PUERTO PLATA PROV.: Lot 135, 1 pupa (MCM). USA: FLORIDA: BROWARD CO.: Lot 132, 1 pupa (MCM). MONROE CO.: Lot 128, 4 pupae (MCM); Lot 130, 5 pupae (MCM); Lot 666, 1 pupa (MCM).

134. *Cymaenes odilia* (Burmeister)

The immature stages of this tropical species are undescribed, and I could not find specimens for study.

Host Plants. POACEAE: *Panicum maximum* (Kendall 1976), *Paspalum* species (Scott 1986).

135. *Lerema accius* (J. E. Smith)

Diagnosis. EGG: height 1.2-1.3mm, width 0.7-0.9mm, polygonal sculpturing, pale green. LAST INSTAR LARVA: BODY: Figure 21E, length 15.5-35mm, A4 transverse width 3-4.9mm; green, frosted with white, heart, subdorsal, and later lines darker green outlined with white; setae simple, to 0.2mm long on A4 dorsum; spiracles tan. HEAD: Figure 29B, pale, medial line dark brown becoming light brown at vertex, epicranial line brown, convergent with medial line along the adfrontals, front with a few dark brown lines, lateral line and postocciput dark brown; transverse width 2.5-3.1mm; setae simple, to 0.1mm long at apex, a few ventral setae to 0.4mm; stemmata subequal (Figure 41J). THORAX: legs pale; shield narrow, a dark brown band between

the annuli. ABDOMEN: prolegs each with about 130 crochets, irregularly triordinal, arranged in a circle or near circle; suranal plate rounded, unmarked (Figure 50B); wax glands forming a ventrolateral patch on A7-8 (Figure 15B). PUPA: Figures 69B and 90A, length 21-28mm, A3 transverse width 3.8-5.2mm; pale green, heart and lateral lines darker green bounded by white; thoracic spiracle guard indistinct; setae simple, < 0.1mm long on head; pilifers touching; head with a long pointed process on cap; antennal tip lies cephalad of tip of middle leg; proboscis extending nearly to distal tip of cremaster; abdomen long; cremaster to 2.5mm long, blunt with numerous hooked setae in a cluster at the tip (Figures 106B and 118A); lenticles present on the prothorax and proleg scars.

Other Descriptions. Edwards and Chapman 1879 (larva, pupa), Scudder 1889a (egg, larva, pupa), Ainslie 1922 (egg, larva, pupa), Minno and Emmel 1993 (larva, pupa).

Host Plants. FABACEAE: *Wisteria frutescens* (Scudder 1889a,b) [erroneous]. POACEAE: *Andropogon* species (Pyle 1981), *Arundinaria gigantea* (MCM collection), *Arundo donax* (MCM collection), *Bambusa* species (DHH collection), *Brachiaria mutica* (MCM collection, DHH collection), *Chasmanthium latifolium* (MCM observation), *Chasmanthium sessiliflorum* (MCM collection), *Cynodon dactylon* (MCM collection, in lab), *Echinochloa crusgalli* (MCM collection), *Echinochloa muriacata* (MCM collection), *Echinochloa*

poiretiana (Hayward 1941), *Echinochloa* species (Pyle 1981),
Erianthus alopecuroides (Edwards and Chapman 1879),
Erianthus giganteus (MCM collection), *Erianthus* species
(Davenport and Dethier 1938), *Heteropogon melanocarpus* (MCM
observation), *Imperata cylindrica* (MCM observation), *Oryza*
sativa (Ainslie 1922), *Oryzopsis* species (Tietz 1952),
Panicum capillare (Ainslie 1922, probably), *Panicum*
clandestinum (MCM observation), *Panicum dichotomiflorum* (MCM
observation), *Panicum gymnocarpum* (MCM collection), *Panicum*
hallii var. *filipes* (ROK collection), *Panicum hemitomon* (MCM
collection), *Panicum laxiflorum* (MCM observation), *Panicum*
maximum (MCM collection), *Panicum rigidulum* (MCM
collection), *Paspalidium geminatum* (MCM observation),
Paspalum ciliatifolium (Scott 1986), *Paspalum dilatatum* (MCM
collection), *Paspalum floridanum* (MCM collection), *Paspalum*
langei (MCM observation), *Paspalum pubiflorum* (MCM
collection), *Paspalum repens* (DHH collection), *Paspalum*
setaceum (Lenczewski 1980), *Pennisetum ciliare* (Lenczewski
1980), *Pennisetum purpureum* (MCM observation), *Phragmites*
australis (ROK collection), *Phyllostachys aurea* (MCM
collection), *Saccharum officinarum* (MCM collection), *Setaria*
grisebachii (MCM collection), *Setaria macrosperma* (Minno and
Emmel 1993), *Sorghum halepense* (Ainslie 1922), *Stenotaphrum*
secundatum (Kendall 1960), *Tridens flavus* (MCM collection),
Tripsacum dactyloides (MCM collection), *Zea mays* (Scudder
1872), *Zizaniopsis miliacea* (MCM collection).

Specimens Examined. EGGS: FLORIDA: ALACHUA CO.: Lot 1514, 8 eggs (MCM). LARVAE: FLORIDA: ALACHUA CO.: Lot 275, 1 larva (instar 5) (MCM); Lot 279, 1 larva (instar 5) (MCM); Lot 284, 1 larva (instar 5) (MCM); Lot 285, 1 larva (instar 5) (MCM); Lot 289, 1 larva (instar 4) (MCM); Lot 290, 4 larvae (instar 1, 5) (MCM); Lot 293, 1 larva (instar 5) (MCM); Lot 294, 3 larvae (instars 3, 5) (MCM); Lot 307, 2 larvae (instar 5) (MCM); Lot 608, 1 larva (instar 4) (SP); Lot 683, 1 larva (instar 5) (MCM); Lot 685, 1 larva (instar 2) (MCM); Lot 686, 1 larva (instar 5) (MCM); Lot 687, 1 larva (instar 2) (MCM); Lot 688, 1 larva (instar 5) (MCM); Lot 689, 1 larva (instar 2) (MCM); Lot 690, 1 larva (instar 5) (MCM); Lot 691, 1 larva (instar 3) (MCM); Lot 1050, 1 larva (instar 5) (DHH); Lot 1055, 1 larva (instar 5) (DHH); Lot 1057, 1 larva (instar 3) (DHH); Lot 1058, 1 larva (instar 3) (DHH); Lot 1059, 1 larva (instar 5) (DHH); Lot 1060, 3 larvae (instars 3, 5) (DHH); Lot 1514, 4 larvae (instar 1) (MCM). BAKER CO.: Lot 775, 1 larva (instar 5) (USNM). BREVARD CO.: Lot 1054, 1 larva (instar 5) (DHH). BROWARD CO.: Lot 272, 1 larva (instar 5) (MCM); Lot 274, 2 larvae (instar 3) (MCM); Lot 278, 1 larva (instar 5) (MCM); Lot 286, 1 larva (instar 5) (MCM). COLLIER CO.: Lot 12, 3 larvae (instar 5) (MCM); Lot 277, 2 larvae (instar 5) (MCM). DADE CO.: Lot 291, 3 larvae (instar 5) (MCM); Lot 776, 1 larva (instar 5) (USNM); Lot 1048, 1 larva (instar 4) (DHH). HIGHLANDS CO.: Lot 684, 1 larva (instar 5) (MCM). LEVY

CO.: Lot 271, 1 larva (instar 5) (MCM). MADISON CO.: Lot 1047, 1 larva (instar 5) (DHH). ORANGE CO.: Lot 1049, 1 larva (instar 5) (DHH). PALM BEACH CO.: Lot 1051, 3 larvae (instar 5) (DHH); Lot 1052, 1 larva (instar 5) (DHH).

PUTNAM CO.: Lot 1056, 1 larva (instar 3) (DHH). SARASOTA CO.: Lot 287, 1 larva (instar 5) (MCM). VOLUSIA CO.: Lot 288, 1 larva (instar 5) (MCM). MARYLAND: PRINCE GEORGE'S CO.: Lot 301, 4 larvae (instar 5) (MCM). NORTH CAROLINA: CRAVEN CO.: Lot 303, 1 larva (instar 3) (MCM). SOUTH CAROLINA: COLLETON CO.: Lot 298, 1 larva (instar 5) (MCM).

GEORGETOWN CO.: Lot 299, 2 larvae (instar 5) (MCM). TEXAS: BEXAR CO.: Lot 295, 3 larvae (instar 5) (MCM); Lot 296, 4 larvae (instar 5) (MCM); Lot 297, 1 larva (instar 5) (MCM).

SAN PATRICIO CO.: Lot 557, 6 larvae (instars 2, 5) (JRH).

PUPAE: FLORIDA: ALACHUA CO.: Lot 279, 1 pupa (MCM); Lot 284, 1 pupa (MCM); Lot 285, 1 pupa (MCM); Lot 292, 2 pupae (MCM); Lot 294, 1 pupa (MCM); Lot 302, 1 pupa (MCM).

BROWARD CO.: Lot 273, 1 pupa (MCM). COLLIER CO.: Lot 12, 2 pupae (MCM). LAKE CO.: Lot 280, 1 pupa (MCM); Lot 281, 6 pupae (MCM). LEVY CO.: Lot 271, 1 pupae (MCM). PALM BEACH CO.: Lot 1053, 3 pupae (DHH). NORTH CAROLINA: COLUMBUS CO.: Lot 300, 2 pupae (MCM). SOUTH CAROLINA: COLLETON CO.: Lot 298, 1 pupa (MCM). GEORGETOWN CO.: Lot 299, 1 pupa (MCM). TEXAS: BEXAR CO.: Lot 296, 2 pupae (MCM).

136. *Lerema liris* Evans

Diagnosis. EGG: height 1.2mm, width 0.7mm, polygonal sculpturing. LAST INSTAR LARVA: BODY: length 20-33mm, A4 transverse width 2.8-4.6mm; preserved specimens pale; setae simple, to 0.2mm long on A4 dorsum; spiracles tan. HEAD: pale, medial and epicranial lines convergent along the adfrontals, brown, front with a few dark brown lines, lateral line dark brown, posterior of head brown; transverse width 2.5-2.6mm; setae simple, to 0.1mm long at apex, a few ventral setae to 0.4mm; stemmata subequal (Figure 41K).

THORAX: legs pale; shield narrow, a dark brown band between the annuli. ABDOMEN: prolegs each with about 130 crochets, irregularly triordinal, arranged in a circle; suranal plate rounded, unmarked. PUPA: Figures 69C and 90B, length 20-24mm, A3 transverse width 3.6-4.4mm; preserved specimens pale; thoracic spiracle guard indistinct; setae simple, < 0.1mm long on head; pilifers touching to nearly touching; head with a long pointed process on cap; antennal tip lies cephalad of tip of middle leg; proboscis extending to tip of the cremaster; abdomen moderately long; cremaster to 2mm long, blunt with numerous hooked setae in a cluster at the tip (Figures 106C and 118B); lenticles present on the prothorax and proleg scars.

Host Plants. POACEAE: *Bambusa vulgaris* (Kendall and McGuire 1975), *Saccharum officinarum* (Kendall and McGuire 1975).

Specimens Examined. LARVAE: MEXICO: TAMAULIPAS: Lot 948, 4 larvae (instars 3, 4, 5) (ROK); Lot 949, 3 larvae (instars 3, 5) (ROK). PUPAE: MEXICO: TAMAULIPAS: Lot 948, 2 pupae (ROK); Lot 949, 2 pupae (ROK).

137. *Perichares philetetes* (Gmelen)

Diagnosis. LAST INSTAR LARVA: BODY: length 27.5-41mm, A4 transverse width 5.1-7.2mm; pale green, heart line darker green bounded by white; setae simple, to 0.9mm long on A4 dorsum; spiracles tan. HEAD: Figure 29C, pale green, unmarked; transverse width 3.4-4.3mm; setae simple, to 0.8mm long at apex, a few ventral setae to 1.1mm; stemmata subequal (Figure 41M). THORAX: legs dark brown; shield indistinct. ABDOMEN: prolegs each with about 210 crochets, irregularly triordinal, arranged in a circle; suranal plate rounded, unmarked (Figure 50C); wax glands forming a ventral, transverse patch on A1 (Figure 15G). PUPA: Figures 60B, 69D, and 90C, length 30-42.5mm, A3 transverse width 5.2-8.2mm; pale green, heart line darker green bounded by pale yellow; thoracic spiracle guard indistinct; setae simple, to 0.4mm long on head; pilifers separated; head with a long, slightly downward pointing process on the cap; antennal and middle leg tips subequal; proboscis extending beyond the cremaster; abdomen long; cremaster to 4.2mm long, bluntly pointed with numerous hooked setae in a cluster at the tip (Figures 106D and 118C); lenticles absent.

Other Descriptions. Panton 1897 (egg, larva, pupa), Wolcott 1922 (larva, pupa), Dethier 1942d (larva), Otero 1943 (larva), Moss 1949 (larva, pupa).

Host Plants. ARECACEAE: *Desmonicus* species (Moss 1949) [questionable], *Hyospathe elegans* (Moss 1949) [questionable]. POACEAE: *Arundo donax* (Bruner et al. 1945), *Bambusa vulgaris* (Wolcott 1941, Kendall and McGuire 1975), *Brachiaria mutica* (Bates 1935), *Oryza sativa* (Otero 1943), *Panicum maximum* (Kaye 1926), *Saccharum officinarum* (Wolcott 1921), *Zea mays* (Kaye 1926).

Specimens Examined. LARVAE: DOMINICAN REPUBLIC: LA VEGA PROV.: Lot 359, 1 larva (instar 5) (MCM); Lot 361, 4 larvae (instars 2, 3, 5) (MCM). PUERTO PLATA PROV.: Lot 362, 6 (instar 2, 3, 5) (MCM). HONDURAS: Lot 614, 1 larva (instar 4) (SP). PUPAE: DOMINICAN REPUBLIC: LA VEGA PROV.: Lot 359, 2 pupae (MCM). PUERTO PLATA PROV.: Lot 360, 1 pupa (MCM); Lot 362, 1 pupa (MCM).

138. *Rhinthon osca* (Plötz)

Nothing is known of the biology of this neotropical species.

139. *Decinea percosius* (Godman)

The immature stages of this tropical species are undescribed, and I could not find specimens for study.

Host Plants. POACEAE: *Cynodon dactylon* (Kendall and Rickard 1976, in lab), *Lolium perenne* (Kendall and Rickard 1976, in lab), *Sorghum halepense* (Kendall and Rickard 1976,

in lab), *Stenotaphrum secundatum* (Kendall and Rickard 1976, in lab).

140. *Conga chydaea* (Butler)

Nothing is known of the biology of this species from tropical America.

141. *Ancyloxypha numitor* (Fabricius)

Diagnosis. EGG: height 0.6-0.7mm, width 0.4-0.5mm, polygonal sculpturing, pale green with a red ring. LAST INSTAR LARVA: BODY: length 14.5-23mm, A4 transverse width 2-2.8mm; green frosted with white, heart line darker green; setae simple, < 0.1mm long on A4 dorsum; spiracles tan. HEAD: Figure 29D, pale, medial and epicranial lines convergent along the adfrontals, brown, front with a few brown lines, lateral line and posterior of head brown; transverse width 1.5-1.9mm; setae simple, < 0.1mm long at apex, a few ventral setae to 0.2mm; stemma 6 small (Figure 41L). THORAX: legs pale to tan; anterior of shield white, posterior black. ABDOMEN: prolegs each with about 60 crochets, irregularly triordinal, arranged in a near circle; suranal plate rounded, unmarked (Figure 50D). PUPA: Figures 69E and 90D, length 12.5-16mm, A3 transverse width 2.1-2.7mm; cream-colored, head and prothorax black; thoracic spiracle guard absent; setae simple, < 0.1 long on head; pilifers touching; head rounded; antennal tip lies far cephalad of tip of middle leg; proboscis extending into A5; abdomen moderately long with a transverse row of short

spines on the dorsum of A5-8, two short ventrolateral rows on A5-7, short spines on proleg scars of A5-6; cremaster to 1.1mm long, broadly rounded with a small downward pointing spine at tip, with numerous hooked setae in a row along distal margin (Figures 106E and 118D); lenticles present on the prothorax, dorsum of abdomen, and proleg scars of A7-8. Other Descriptions. Harris 1862 (pupa), Edwards 1884 (egg), Scudder 1889a (egg, larva, pupa), Dethier 1938b (larva, pupa).

Host Plants. FABACEAE: *Lespedeza capitata* (Scudder 1869) [erroneous]. POACEAE: *Agrostis hiemalis* (ROK collection), *Leersia hexandra* (MCM collection), *Leersia oryzoides* (Shapiro and Shapiro 1973), *Oryza sativa* (Ross and Lambremont 1963), *Panicum* species (Pyle 1981, associated with: Scott 1986), *Phalaris arundinacea* (Layberry et al. 1982, possibly), *Poa* species (Shapiro 1966), *Setaria* species (Beutenmüller 1889), *Spartina* species (Field 1938), *Zea mays* (Tietz 1952), *Zizaniopsis miliacea* (Kendall 1966b).

Specimens Examined. EGGS: FLORIDA: ALACHUA CO.: Lot 1522, 10 eggs (MCM). LARVAE: FLORIDA: ALACHUA CO.: Lot 1522, 1 larva (instar 1) (MCM). BROWARD CO.: Lot 55, 1 larva (instar 5) (MCM); Lot 56, 1 larva (instar 5) (MCM); Lot 57, 7 larvae (instar 5) (MCM). TEXAS: SAN SABA CO.: Lot 901, 3 larvae (instars 4, 5) (ROK). PUPA: FLORIDA: BROWARD CO.: Lot 56, 1 pupa (MCM); Lot 57, 5 pupae (MCM).

142. *Ancyloxypha arene* (Edwards)

Diagnosis. LAST INSTAR LARVA: BODY: length 12-17mm, A4 transverse width 1.6-2.1mm; preserved specimens pale; setae simple, to 0.1mm long on A4 dorsum; spiracles pale. HEAD: Figure 29E, pale, epicranial line wide and convergent with medial line along the adfrontals, black, front with a few black lines, lateral line black, posterior of head dark brown; transverse width 1.5-1.7mm; setae simple, < 0.1mm long at apex, a few ventral setae to 0.2mm; stemma 6 small (Figure 41N). THORAX: legs pale to tan; anterior of shield white, posterior black. ABDOMEN: prolegs each with about 60 crochets, irregularly triordinal, arranged in a near circle; suranal plate rounded with two black longitudinal lines (Figure 50E). PUPA: Figures 69F and 90E, length 13-13.5mm, A3 transverse width 2.3-2.6mm; preserved specimens pale, head and prothorax blackish; thoracic spiracle guard indistinct; setae simple, < 0.1mm long on head; pilifers touching; head rounded; antennal tip lies far cephalad of tip of middle leg; proboscis extending into A5; abdomen moderately long with a transverse row of short spines on the dorsum of A6-8, two short ventrolateral rows on A5-7, short spines on proleg scars of A5-6; cremaster to 1.1mm long, broadly rounded with a small downward pointing spine at tip, numerous hooked setae in a row along distal margin (Figures 106F and 118E); lenticles present on the prothorax and dorsum of abdomen.

Host Plants. POACEAE: *Echinochloa crusgalli* (Bailowitz and Brock 1991), *Polypogon simiverticillata* (Tilden and Smith 1986), *Polypogon viridis* (Bailowitz and Brock 1991).

Specimens Examined. LARVAE: TEXAS: KINNEY CO.: Lot 900, 5 larvae (instar 5) (ROK). PUPAE: TEXAS: KINNEY CO.: Lot 900, 2 pupae (ROK).

143. *Oarisma poweshiek* (Parker)

I could not find immature specimens of this midwestern species for study. Willard (1892) and McAlpine (1973) described the egg, larva, and pupa.

Host Plants. CYPERACEAE: *Carex* species (McCabe and Post 1977), *Eleocharis elliptica* (Opler and Krizek 1984).

POACEAE: *Poa* species (McCabe and Post 1977, in lab).

144. *Oarisma garita* (Reakirt)

I could not find immature specimens of this western species for study, but Gibson (1910) gave a description of the egg and larva.

Host Plants. POACEAE: *Blepharoneuron tricholepis* (Scott and Scott 1980), *Bouteloua gracilis* (Scott 1986), *Poa agassizensis* (Scott 1986), *Poa pratensis* (Gibson 1910, in lab), *Sitanion hystrrix* (Scott and Scott 1980), *Stipa columbiana* (Scott and Scott 1980).

145. *Oarisma edwardsii* (Barnes)

Nothing is known of the biology of this western species.

146. *Copaeodes aurantiacus* (Hewitson)

Diagnosis. EGG: height 0.9-1mm, width 0.5-0.6mm, polygonal sculpturing. LAST INSTAR LARVA: BODY: length 15-23.5mm, A4 transverse width 2-2.6mm; preserved specimens pale, subdorsal and lateral lines outlined with white; setae simple, < 0.1mm long on A4 dorsum; spiracles tan. HEAD: Figure 29F, pale, unmarked, with two adjacent, forward pointing processes at apex; transverse width 1.7-1.9mm; setae simple, < 0.1mm long at apex, a few ventral setae to 0.1mm; stemma 6 small (Figure 410). THORAX: legs pale to tan; shield indistinct. ABDOMEN: prolegs each with about 60 crochets, irregularly triordinal, arranged in a mesal penellipse; suranal plate pointed, unmarked (Figure 50F). PUPA: Figures 69G and 90F, length 16-19mm, A3 transverse width 2.1-3mm; preserved specimens pale, heart, subdorsal, and lateral lines outlined with white; thoracic spiracle guard indistinct; setae simple, < 0.1mm long on head; pilifers touching; head with a long pointed process on cap; antennal tip lies far cephalad of tip of middle leg; proboscis extending into A6; abdomen long; cremaster to 1.4mm long, blunt with numerous hooked setae in a cluster at the tip (Figures 106G and 118F); lenticles absent.

Other Descriptions. Comstock 1929 (egg, larva, pupa), Emmel and Emmel 1973 (egg, larva, pupa).

Host Plants. POACEAE: *Bouteloua curtipendula* (Bailowitz and Brock 1991), *Cynodon dactylon* (Wright 1905), *Digitaria*

sanguinalis (Tietz 1972), *Distichlis spicata* (Gunder 1930), *Leptochloa dubia* (Bailowitz and Brock 1991).

Specimens Examined. EGGS: TEXAS: BEXAR CO.: Lot 931, 5 eggs (ROK). LARVAE: ARIZONA: SANTA CRUZ CO.: Lot 788 (probably), 1 larva (instar 5) (USNM). TEXAS: BEXAR CO.: Lot 931, 11 larvae (instar 5) (ROK). PUPAE: TEXAS: BEXAR CO.: Lot 931, 8 pupae (ROK).

147. *Copaeodes minimus* (Edwards)

Diagnosis. EGG: Figure 3H, height 0.7-0.8mm, width 0.4-0.5mm, polygonal sculpturing, white. LAST INSTAR LARVA: BODY: length 14-19mm, A4 transverse width 2.1-3.1mm; green, heart line darker green outlined with white, lateral line yellow; setae simple, < 0.1mm long on A4 dorsum; spiracles tan. HEAD: Figure 29G, green, unmarked, rounded; transverse width 1.7-1.8mm; setae simple, < 0.1mm long at apex, a few ventral setae to 0.2mm; stemma 1 and 6 small (Figure 41P). THORAX: legs pale; shield indistinct. ABDOMEN: prolegs each with about 50 crochets, irregularly triordinal, arranged in a mesal penellipse; suranal plate pointed, unmarked (Figure 50G). PUPA: Figures 70A and 90G, length 15-16mm, A3 transverse width 2.3-2.8mm; green, heart line and lateral lines faintly outlined with white; setae simple, < 0.1mm long on head; pilifers touching; head with a long pointed process on cap; antennal tip lies far cephalad of tip of middle leg; proboscis extending into A5; abdomen long; cremaster to 1.6mm long, blunt with numerous hooked

setae in a cluster at the tip (Figures 106H and 118G); lenticles absent.

Other Descriptions. Minno and Emmel 1993 (larva, pupa).

Host Plants. POACEAE: *Cynodon dactylon* (Kendall 1960).

Specimens Examined. EGGS: FLORIDA: ALACHUA CO.: Lot 1517, 6 eggs (MCM). LARVAE: FLORIDA: ALACHUA CO.: Lot 1061, 1 larva (instar 5) (DHH); Lot 1063, 1 larva (instar 5) (DHH); Lot 1517, 11 larvae (instar 1) (MCM). BROWARD CO.: Lot 127, 10 larvae (instars 1, 5) (MCM). TEXAS: LASALLE CO.: Lot 796, 3 larvae (instars 4, 5) (USNM); Lot 797, 1 larva (instar 5) (USNM). PUPAE: FLORIDA: BROWARD CO.: Lot 127, 4 pupae (MCM).

148. *Adopaeoides prittwitzi* (Plötz)

The immature stages of this southwestern species are undescribed, and I could not find specimens for study.

Host Plants. POACEAE: *Paspalum disticum* (Bailowitz and Brock 1991).

149. *Thymelicus lineola* (Ochsenheimer)

Diagnosis. LAST INSTAR LARVA: BODY: length 21mm, A4 transverse width 4.1mm; preserved specimens pale; setae simple, to 0.1mm long on A4 dorsum; spiracles tan. HEAD: Figure 29H, tan, unmarked; transverse width 2.2mm; setae simple, to 0.1mm long at apex, a few ventral setae to 0.2mm; stemma 1 and 6 small (Figure 41Q). THORAX: legs pale; shield indistinct. ABDOMEN: prolegs each with about 60

crochets, irregularly triordinal, arranged in a near circle; suranal plate rounded, unmarked (Figure 51A).

Other Descriptions. Forbes 1960 (larva, pupa), Pengelly 1961 (egg, larva, pupa), Toliver 1987 (larva).

Host Plants. CYPERACEAE: *Carex* species (Pengelly 1961, larval feeding, but doubtful if sedge served as an oviposition substrate). POACEAE: *Agropyron repens* (Pengelly 1961), *Agrostis alba* (Pengelly 1965), *Avena sativa* (Pengelly 1961), *Bromus inermis* (Pengelly 1961, in lab), *Dactylis glomerata* (Bucher and Arthur 1961), *Festuca elatior* (Pengelly 1961), *Lolium perenne* (Pengelly 1961), *Phleum pratense* (Bucher and Arthur 1961), *Poa compressa* (Arthur and Smith 1974), *Poa pratensis* (Pengelly 1965).

Specimens Examined. LARVAE: NEW YORK: TOMPKINS CO.: Lot 545, 1 larva (instar 4) (TLM).

150. *Hylephila phyleus* (Drury).

Diagnosis. EGG: Figure 3E, height 0.7-0.8mm, width 0.5-0.6mm, polygonal sculpturing, pale green. LAST INSTAR LARVA: BODY: length 14-34.5mm, A4 transverse width 3.2-5.3mm; brown, heart line darker brown, subdorsal line faint, dark; setae simple, to 0.1mm long on A4 dorsum; spiracles tan. HEAD: Figure 30A, black with two pale lines parallel to vertex, adfrontals mostly pale, front with two pale spots, a pale eye patch containing a central black spot present; transverse width 2.7-3.3mm; sculpturing rough to pitted; setae simple, < 0.1mm long at apex, a few ventral

setae to 0.3mm; stemmata subequal (Figure 41R). THORAX: legs very dark brown; shield broad, very dark brown. ABDOMEN: prolegs each with about 120 crochets, irregularly triordinal, arranged in a circle; suranal plate rounded, unmarked (Figure 51B); no wax glands. PUPA: Figures 70B and 91A, length 15-28mm, A3 transverse width 3.8-5.2mm; cream-colored with a dark brown dorsal line on the thorax and abdomen, other short dark brown lines on head and mesothorax, tiny dark brown spots on the head, thorax, and abdomen; thoracic spiracle guard distinct; setae simple, to 0.5mm long on head; pilifers touching; head rounded; antennal tip lies far cephalad of tip of middle leg; proboscis extending into A6; abdomen moderately long; cremaster to 1.3mm long, bluntly pointed with numerous hooked setae in a cluster at the tip (Figures 106I and 118H); lenticles present on the prothorax, dorsum of abdomen, and proleg scars.

Other Descriptions. Edwards and Chapman 1879 (larva, pupa), Panton 1897 (egg, larva, pupa), Coquillett 1899 (larva), Coolidge 1925 (egg, larva, pupa), Comstock 1927b (egg, larva, pupa), Comstock and Dammers 1933a (egg, larva, pupa), Dethier 1939b (larva), Moss 1949 (larva), Peterson 1962 (larva), Emmel and Emmel 1973 (egg, larva, pupa), Hogue 1974 (larva), Tashiro and Mitchell 1985 (egg, larva, pupa), Minno and Emmel 1993 (egg, larva, pupa).

Host Plants. CANNACEAE: *Canna* species (da Costa Lima 1936) [erroneous]. EUPHORBIACEAE: *Euphorbia* species (Orsak 1978, oviposition substrate only). POACEAE: *Agrostis* species (Bohart 1947), *Axinopus compressus* (Brown and Heineman 1972), *Cynodon dactylon* (Coolidge 1925), *Digitaria sanguinalis* (Scudder 1872), *Eragrostis hypnoides* (Scott 1986), *Panicum* species (Bates 1935), *Paspalum conjugatum* (Kaye 1926), *Poa pratensis* (Tietz 1952), *Saccharum officinarum* (Dethier 1942d, in lab), *Stenotaphrum secundatum* (Kendall 1960). ROSACEAE: *Rosa* species (Wright 1905) [erroneous].

Specimens Examined. EGGS: CALIFORNIA: SAN BERNARDINO CO.: Lot 631, 4 eggs (TCE). FLORIDA: PUTNAM CO.: Lot 1524, 12 eggs (MCM). LARVAE: CALIFORNIA: RIVERSIDE CO.: Lot 575, 2 larvae (instar 5) (GRB); Lot 1040, 1 larva (instar 5) (DHH). SAN BERNARDINO CO.: Lot 631, 9 larvae (instars 1, 2, 3, 4, 5) (TCE). YOLO CO.: Lot 261, 14 larvae (instars 2, 3, 4, 5) (MCM); Lot 266, 21 larvae (instars 2, 3, 4, 5) (MCM). FLORIDA: ALACHUA CO.: Lot 9, 5 larvae (instar 5) (MCM); Lot 258, 5 larvae (instar 5) (MCM); Lot 260, 4 larvae (instar 5) (MCM); Lot 1039, 1 larva (instar 5) (DHH); Lot 1042 (possibly), 1 larva (instar 5) (DHH). BROWARD CO.: Lot 259, 4 larvae (instar 5) (MCM). PUTNAM CO.: Lot 1524, 14 larvae (instar 1) (MCM). NEW MEXICO: BERNALILLO CO.: Lot 678, 5 larvae (instar 5) (MCM); Lot 679, 1 larva (instar 5) (MCM); Lot 680, 4 larvae (instar 5) (MCM); Lot 682, 4

larvae (instar 5) (MCM). PUPAE: USA: CALIFORNIA: SAN BERNARDINO CO.: Lot 631, 1 pupa (TCE). YOLO CO.: Lot 262, 26 pupae (MCM); Lot 263, 25 pupae (MCM); Lot 264, 25 pupae (MCM). FLORIDA: ALACHUA CO.: Lot 9, 2 pupae (MCM); Lot 258, 3 pupae (MCM); Lot 260, 2 pupae (MCM). BROWARD CO.: Lot 259, 5 pupae (MCM). NEW MEXICO: BERNALILLO CO.: Lot 678, 4 pupae (MCM); Lot 679, 1 pupa (MCM); Lot 680, 6 pupae (MCM); Lot 681, 7 pupae (MCM); Lot 682, 6 pupae (MCM).

151. *Yvretta rhesus* (Edwards)

The immature stages of this western species are undescribed, and I could not find specimens for study. Little is known of the biology of this species, except that the grass, *Bouteloua gracilis*, is a host (Scott and Scott 1980).

152. *Yvretta carus* (Edwards)

Diagnosis. LAST INSTAR LARVA: BODY: length 28-28.5mm, A4 transverse width 4.8-5.3mm; preserved specimens pale; setae simple, to 0.2mm long on A4 dorsum; spiracles tan. HEAD: Figure 30B, black with two pale lines parallel to vertex, adfrontals pale, front with two small pale spots; a pale eye patch present; transverse width 3.1mm; sculpturing rough; setae simple, to 0.1mm long at apex, a few ventral setae to 0.4mm; stemmata subequal (Figure 41S). THORAX: legs dark brown; shield broad, dark brown. ABDOMEN: prolegs each with about 70 crochets, irregularly triordinal, arranged in a circle; suranal plate rounded with three black

longitudinal lines (Figure 51C). PUPA: Figures 70C and 91B, length 27.5mm, A3 transverse width 4.8mm; light brown; thoracic spiracle guard distinct; setae simple, to 0.5mm long on head; pilifers touching; head rounded; antennal tip lies far cephalad of tip of middle leg; proboscis extending into A6; abdomen moderately long; cremaster to 1.9mm long, bluntly pointed with numerous hooked setae in a cluster at the tip (Figures 106J and 118I); lenticles present on the prothorax and proleg scars.

Host Plants. POACEAE: *Cynodon dactylon* (MCM collection, in lab).

Specimens Examined. LARVAE: ARIZONA: SANTA CRUZ CO.: Lot 528, 2 larvae (instar 5) (MCM). PUPAE: ARIZONA: SANTA CRUZ CO.: Lot 528, 1 pupa (MCM).

153. *Pseudocopaeodes eunus* (Edwards)

Diagnosis. LAST INSTAR LARVA: BODY: length 22.5mm, A4 transverse width 4.8mm; preserved specimen pale; some setae with blunt tips, to 0.2mm long on A4 dorsum; spiracles black. HEAD: Figure 30C, black with two pale lines parallel to vertex extending onto the adfrontals, front without pale spots, a pale eye patch present; transverse width 2.9mm; sculpturing rough to pitted; setae simple, to 0.2mm long at apex, a few ventral setae to 0.5mm; stemmata subequal (Figure 41T). THORAX: legs dark brown; shield broad, dark brown. ABDOMEN: prolegs each with about 50 crochets, irregularly triordinal, arranged in a near circle;

suranal plate rounded, unmarked (Figure 51D). PUPA: Figures 70D and 91C, length 16mm, A3 transverse width 4.3mm; light brown; thoracic spiracle guard distinct; setae simple, to 0.2mm long on head; pilifers touching; head rounded; antennal tip lies far cephalad of tip of middle leg; proboscis extending into A6; abdomen moderately long; cremaster to 1.3mm long, blunt with numerous hooked setae in a cluster at the tip (Figures 106K and 118J); lenticles present on the prothorax and proleg scars.

Other Descriptions. Comstock 1932a (egg).

Host Plants. POACEAE: *Distichlis spicata* (Emmel and Emmel 1973, probably), *Distichlis spicata* var. *stricta* (MacNeill 1975).

Specimens Examined. LARVAE: CALIFORNIA: INYO CO.: Lot 434, 1 larva (instar 5) (MCM). PUPAE: CALIFORNIA: INYO CO.: Lot 434, 1 pupa (MCM).

154. *Stinga morrisoni* (Edwards)

The immature stages of this western species are mostly undescribed, and I could not find specimens for study. Emmel et al. (1992) noted that the eggs are relatively large and white. Nothing is known of the biology of this species. Stanford (1981) thought that the grasses, *Andropogon scoparius* and *Bouteloua gracilis*, may be hosts.

155. *Hesperia uncas* Edwards

Diagnosis. LAST INSTAR LARVA: BODY: length 21-29mm, A4 transverse width 4.6-5.4mm; brown; setae simple, < 0.1mm

long on A4 dorsum; spiracles dark brown. HEAD: Figure 30D, black with two pale lines parallel to vertex, adfrontals pale, front with two small pale spots; transverse width 3.3-3.5mm; sculpturing rough to pitted; setae simple, to 0.2mm long at apex, a few ventral setae to 0.4mm; stemmata subequal (Figure 41U). THORAX: legs dark brown; shield broad, dark brown. ABDOMEN: prolegs each with about 70 crochets, irregularly triordinal, arranged in a near circle; suranal plate rounded, unmarked (Figure 51E). PUPA: Figures 70E and 91D, length 18-22mm, A3 transverse width 3.7-4.1mm; pale green, abdomen cream-colored with small dark spots; thoracic spiracle guard distinct; setae simple, to 0.4mm long on head; pilifers touching; head rounded; antennal tip lies far cephalad of tip of middle leg; proboscis extending into A6; abdomen long; cremaster to 1.9mm long, bluntly pointed with numerous hooked setae in a cluster at the tip (Figures 106L and 118K); lenticles present on the prothorax, abdomen, and proleg scars.

Other Descriptions. MacNeill 1964 (egg), Scott 1975a (larva, pupa), Emmel et al. 1992 (egg, larva, pupa).

Host Plants. POACEAE: *Bouteloua gracilis* (Shields et al. 1970), *Bouteloua uniflora* (Scott 1986), *Erioneuron pilosum* (McGuire 1982), *Poa pratensis* (McCabe and Post 1977, in lab), *Stipa nevadensis* (MacNeill 1975), *Stipa pinetorum* (McGuire 1982).

Specimens Examined. LARVAE: COLORADO: EL PASO CO.: Lot 256, 6 larvae (instars 3, 4, 5) (MCM); Lot 257, 12 larvae (instars 2, 3, 4) (MCM). NORTH DAKOTA: SLOPE CO.: Lot 550, 1 larva (instar 5) (TLM). PUPAE: COLORADO: EL PASO CO.: Lot 256, 3 pupae (MCM).

156. *Hesperia juba* (Scudder)

Diagnosis. LAST INSTAR LARVA: BODY: length 22.5-39mm, A4 transverse width 4.4-6mm; preserved specimen brownish; some setae with expanded tips, to 0.1mm long on A4 dorsum; spiracles dark brown. HEAD: black with two pale lines parallel to the vertex, adfrontals pale, front with two small pale spots; transverse width 3.6-3.8mm; sculpturing rough to pitted; setae simple, to 0.1mm long at apex, a few ventral setae to 0.4mm; stemmata subequal (Figure 41V). THORAX: legs dark brown; shield broad, dark brown. ABDOMEN: prolegs each with about 70 crochets, irregularly triordinal, arranged in a circle or near circle; suranal plate rounded, unmarked; wax glands in transverse patches on the ventral side of A7 and A8 (Figure 15E).

Other Descriptions. Lindsey 1923 (egg, larva), MacNeill 1964 (egg, larva, pupa).

Host Plants. POACEAE: *Bromus rubens* (McGuire 1982), *Deschampsia elongata* (McGuire 1982), *Poa agassizensis* (Scott 1986), *Poa pratensis* (Scott 1986), *Stipa* species (McGuire 1982).

Specimens Examined. LARVAE: CALIFORNIA: SAN BERNARDINO CO.: Lot 578, 2 larvae (instar 5) (GRB).

157. *Hesperia comma* (Linnaeus)

Diagnosis. EGG: height 1.1mm, width 0.7mm, polygonal sculpturing. LAST INSTAR LARVA: BODY: length 15-28.5mm, A4 transverse width 4.3-6mm; brownish; some setae with blunt or slightly expanded tips, < 0.1mm long on A4 dorsum; spiracles dark brown. HEAD: black with two pale lines parallel to the vertex, adfrontals mostly pale, front with two small pale spots; transverse width 3-3.4mm; sculpturing rough to pitted; setae simple, < 0.1mm long at apex, a few ventral setae to 0.4mm; stemmata subequal (Figure 41W). THORAX: legs dark brown; shield broad, dark brown. ABDOMEN: prolegs each with about 75 crochets, irregularly triordinal, arranged in a circle; suranal plate rounded, unmarked. PUPA: Figures 70F and 91E, length 17.5-24.5mm, A3 transverse width 5-5.6mm; cream-colored; thoracic spiracle guard distinct; setae simple, to 0.3mm long on head; pilifers touching; head rounded; antennal tip lies far cephalad of tip of middle leg; proboscis extending into A6; abdomen long; cremaster to 2mm long, bluntly pointed with numerous hooked setae in a cluster at the tip (Figures 107A and 119A); lenticles present on the prothorax, dorsal abdomen, and proleg scars.

Other Descriptions. Fletcher 1888 (egg, larva), Fyles 1895 (egg, larva, pupa), Cockayne 1952 (larva), MacNeill 1964

(egg, larva, pupa), Scott 1975a (egg, larva, pupa), McCabe and Post 1977 (larva), Emmel et al. 1992 (egg, larva).

Host Plants. POACEAE: *Andropogon saccharoides* (Scott 1986), *Bouteloua gracilis* (Scott 1986), *Bromus* species (Hardy 1954), *Festuca rubra* (MacNeill 1964), *Koeleria cristata* (Klassen et al. 1989), *Lolium* species (Hardy 1954), *Muhlenbergia* species (McGuire 1982), *Phleum pratense* (Fyles 1895, in lab), *Poa arctica* (Scott 1986), *Poa glauca* (Scott 1986), *Poa pratensis* (Tietz 1972), *Poa scabrella* (MacNeill 1964), *Stipa thurberiana* (MacNeill 1975), *Vulpia octaflora* (McGuire 1982, associated with).

Specimens Examined. EGGS: CANADA: NEW BRUNSWICK: VICTORIA CO.: Lot 999, 7 eggs (FSCA). LARVAE: CANADA: NEW BRUNSWICK: VICTORIA CO.: Lot 999, 13 larvae (instars 1, 5) (FSCA). CALIFORNIA: SAN DIEGO CO.: Lot 254, 2 larvae (instar 5) (MCM). COLORADO: TELLER CO.: Lot 255, 8 larvae (instars 1, 2, 5) (MCM). NORTH DAKOTA: SLOPE CO.: Lot 548, 1 larva (instar 5) (TLM). PUPAE: CANADA: NEW BRUNSWICK: VICTORIA CO.: Lot 999, 1 pupa (FSCA). CALIFORNIA: SAN DIEGO CO.: Lot 254, 2 pupae (MCM).

158. *Hesperia woodgatei* (R. C. Williams)

Diagnosis. EGG: height 1.1-1.3mm, width 0.8-1mm, polygonal sculpturing. LAST INSTAR LARVA: BODY: length 27mm, A4 transverse width 4.8mm; preserved specimens brownish; some setae with expanded tips, < 0.1mm long on A4 dorsum; spiracles dark brown. HEAD: black with two pale lines

parallel to the vertex, adfrontals mostly pale, front with two small pale spots; transverse width 3.7mm; sculpturing pitted; setae simple, < 0.1mm long at apex, a few ventral setae to 0.4mm; stemmata subequal (Figure 41X). THORAX: legs black; shield broad, black. ABDOMEN: prolegs each with about 80 crochets, irregularly triordinal, arranged in a circle; suranal plate rounded, unmarked. PUPA: length 14.5mm, A3 transverse width 4.83mm; cream-colored with dark markings on the head and thorax; thoracic spiracle guard distinct; setae simple, to 0.2mm long on head; pilifers touching; head rounded; antennal tip lies far cephalad of tip of middle leg; proboscis extending into A5; abdomen short; cremaster to 1.6mm long, bluntly pointed with numerous hooked setae in a cluster at the tip (Figures 107B and 119B); lenticles present on the prothorax, dorsal abdomen, and proleg scars.

Other Descriptions. MacNeill 1964 (egg), Pyle 1981 (egg, larva, pupa).

Host Plants. POACEAE: *Bouteloua uniflora* var. *coahuilensis* (ROK collection).

Specimens Examined. EGGS: MEXICO: COAHUILA: Lot 947, 2 eggs (ROK), probably this species. LARVAE: MEXICO: COAHUILA: Lot 947, 6 larvae (instars 1, 4, 5) (ROK), probably this species. PUPAE: MEXICO: COAHUILA: Lot 947, 1 pupa (ROK), probably this species.

159. *Hesperia ottoe* Edwards

The egg and larva of this species was described by Nielsen (1958, 1960), but I could not find specimens for study.

Host Plants. ASTERACEAE: *Echinacea pallida* (Dana 1981) [oviposition substrate only]. POACEAE: *Andropogon gerardii* (Stanford 1981, probably; Scott 1986), *Andropogon scoparius* (McGuire 1982), *Bouteloua curtipendula* (Scott 1986), *Bouteloua gracilis* (Scott 1986), *Bouteloua hirsuta* (Scott 1986), *Bromus* species (Scott 1986), *Leptoloma cognatum* (Nielsen 1958), *Panicum (wilcoxianum?)* (Scott 1986), *Sporobolus neglecta* (Scott 1986).

Specimens Examined. LARVAE: NORTH DAKOTA: BILLINGS CO.: Lot 542, 1 larva (instar 1) (TLM).

160. *Hesperia leonardus* Harris

Diagnosis. LAST INSTAR LARVA: BODY: length 13-15mm, A4 transverse width 3.5-3.6mm; preserved specimens brownish; some setae with expanded tips, < 0.1mm long on A4 dorsum; dark brown. HEAD: Figure 30E, black with two pale lines parallel to vertex, adfrontals mostly pale, front with two pale spots, a pale eye patch present; transverse width 3.5mm; sculpturing pitted; setae simple, to 0.1mm long at apex, a few ventral setae to 0.4mm; stemmata subequal (Figure 41Y). THORAX: legs dark brown; shield broad, dark brown. ABDOMEN: prolegs each with about 60 crochets,

irregularly triordinal, arranged in a circle or near circle; suranal plate rounded, unmarked.

Other Descriptions. Scudder 1889a (egg, young larva), Dethier 1939a (young larva), Dethier 1948 (larva, pupa), Scott 1975a (egg, larva, pupa).

Host Plants. ASTERACEAE: *Taraxacum officinale* (Tietz 1972) [oviposition substrate only]. POACEAE: *Agrostis* species (Scudder 1893), *Andropogon* species (Opler and Krizek 1984, associated with), *Danthonia spicata* (McGuire 1982), *Eragrostis alba* (Shapiro 1966), *Panicum virgatum* (Shapiro 1966), *Sporobolus heterolepis* (Scott 1986).

Specimens Examined. LARVAE: PENNSYLVANIA: HUNTINGDON CO.: Lot 1008, 2 larvae (instar 5) (FSCA).

161. *Hesperia pawnee* Dodge

Scott (1975a) has described the egg, larva, and pupa of this upper Great Plains species, but I could not find specimens for study.

Host Plants. POACEAE: *Andropogon scoparius* (Scott 1986), *Bouteloua curtipendula* (Scott 1986), *Bouteloua gracilis* (Stanford 1981, probably; Scott and Stanford 1982), *Bouteloua hirsuta* (Scott 1986), *Cynodon dactylon* (Scott and Stanford 1982, in lab), *Poa pratensis* (Scott and Stanford 1982, in lab), *Stipa comata* (McCabe and Post 1977), *Tridens* species (Pyle 1981).

162. *Hesperia pahaska* (Leussler)

Diagnosis. LAST INSTAR LARVA: BODY: length 25.5-29mm, A4 transverse width 4.8-5.5mm; preserved specimens pale; some setae with slightly expanded tips, < 0.1mm long on A4 dorsum; spiracles tan. HEAD: Figure 30F, black with pale patches on upper face, two pale lines parallel to the vertex, adfrontals mostly pale, front with two small pale spots, a pale eye patch present; transverse width 3.5-3.7mm; sculpturing pitted; setae simple, to 0.1mm long at apex, a few ventral setae to 0.5mm; stemmata subequal (Figure 41Z). THORAX: legs dark brown; shield broad, dark brown. ABDOMEN: prolegs each with about 90 crochets, irregularly triordinal, arranged in a circle or near circle; suranal plate rounded, unmarked.

Other Descriptions. MacNeill 1964 (egg, larva, pupa), Scott 1975a (larva, pupa).

Host Plants. POACEAE: *Bouteloua gracilis* (MacNeill 1975), *Erioneuron pulchellum* (Emmel and Emmel 1973), *Tridens pulchellus* (MacNeill 1964).

Specimens Examined. LARVAE: CALIFORNIA: SAN BERNARDINO CO.: Lot 1497, 4 larvae (instar 5) (MCM).

163. *Hesperia columbia* (Scudder)

MacNeill (1964) described the egg, larva, and pupa of this western species, but I could not find specimens for study.

Host Plants. POACEAE: *Danthonia californica* (Emmel and Emmel 1973, probably), *Koeleria cristata* (MacNeill 1964), *Koeleria macrantha* (Garth and Tilden 1986).

164. *Hesperia metea* Scudder

I could not locate eggs, mature larvae, or pupae of this species for study. Figure 41AA shows the stemmatal pattern of a fourth instar larva.

Other Descriptions. Scudder 1881 (larva), Scudder 1889a (egg, young larva), Laurent 1908 (larva, pupa), Heitzman and Heitzman 1970b (egg, larva).

Host Plants. POACEAE: *Andropogon gerardii* (Heitzman and Heitzman 1970b), *Andropogon glomeratus* (Shapiro 1965, associated with; Shapiro 1966), *Andropogon scoparius* (Shapiro 1965, associated with; Shapiro 1966), *Andropogon virginicus* var. *abbreviatus* (Shapiro 1966, possibly; Scott 1986), *Andropogon* species (Macy and Shepard 1941), *Panicum* species (Scudder 1869, probably).

Specimens Examined. LARVAE: GEORGIA: DEKALB CO.: Lot 945, 1 larva (instar 4) (ROK).

165. *Hesperia viridis* (Edwards)

Diagnosis. LAST INSTAR LARVA: BODY: length 14mm, A4 transverse width 4.3mm; preserved specimens brown; some setae with expanded tips, < 0.1mm long on A4 dorsum; spiracles dark brown. HEAD: black with two pale lines parallel to the vertex, adfrontals pale, front with two pale spots; transverse width 3.7mm; sculpturing pitted; setae

simple, to 0.1mm long at apex, a few ventral setae to 0.4mm; stemmata subequal (Figure 41BB). THORAX: legs dark brown; shield broad, dark brown. ABDOMEN: prolegs each with about 65 crochets, irregularly triordinal, arranged in a near circle; suranal plate rounded, unmarked. PUPAL EXUVIUM: cremaster blunt with numerous hooked setae in a cluster at the tip (Figures 107C and 119C).

Other Descriptions. MacNeill 1964 (egg), Scott 1975a (larva, pupa).

Host Plants. POACEAE: *Bouteloua curtipendula* (Scott 1986), *Bouteloua gracilis* (Kendall 1965, possibly; MacNeill 1975), *Buchloe dactyloides* (McGuire 1982), *Cynodon dactylon* (Kendall 1965, in lab), *Erioneuron pilosum* (McGuire 1982), *Lolium perenne* (Kendall 1965, in lab), *Tridens muticus* (McGuire 1982).

Specimens Examined. EGGS: TEXAS: BEXAR CO.: Lot 946, 2 egg shells (ROK). LARVAE: TEXAS: BEXAR CO.: Lot 946, 12 larvae (instars 1, 3, 5) (ROK).

166. *Hesperia attalus* (Edwards)

Diagnosis. EGG: Figure 4D, height 1.2-1.5mm, width 0.9-1.2mm, polygonal sculpturing, white. LAST INSTAR LARVA: BODY: Figure 20E, length 20.5-28mm, A4 transverse width 3.6-5.6mm; olive green or brownish; some setae with blunt or slightly expanded tips, < 0.1mm long on A4 dorsum; spiracles black. HEAD: black with two pale lines parallel to the vertex, adfrontals mostly pale, front with two pale spots;

transverse width 3.3-5.6mm; sculpturing pitted; setae simple, < 0.1mm long at apex, a few ventral setae to 0.2mm; stemmata subequal (Figure 42A). THORAX: T1-2 legs dark brown, T3 legs brown; shield broad, dark brown. ABDOMEN: prolegs each with about 90 crochets, irregularly triordinal, arranged in a circle; suranal plate rounded, unmarked; wax glands forming two ventral transverse patches on A7-8. PUPA: Figures 59A, 70G, and 91F, length 19-23mm, A3 transverse width 4.5-4.8mm; pale green, abdomen cream-colored with small light brown spots; thoracic spiracle guard distinct; setae simple, to 0.2mm long on head; pilifers touching; head rounded; antennal tip lies far cephalad of tip of middle leg; proboscis extending into A8; abdomen long; cremaster to 1.8mm long, bluntly pointed with numerous hooked setae in a cluster at the tip (Figures 107D and 119D); lenticles present on the prothorax and lenticle scars.

Host Plants. POACEAE: *Aristida stricta* (MCM collection, in lab), *Aristida virgata* (McGuire 1982), *Bothriochloa barbinodis* (McGuire 1982, possibly), *Bouteloua curtipendula* var. *caespitosa* (McGuire 1982), *Cynodon dactylon* (MCM collection, in lab), *Leptoloma cognatum* (McGuire 1982), *Panicum virgatum* (Shapiro and Shapiro 1973, associated with).

Specimens Examined. EGGS: FLORIDA: LEVY CO.: Lot 248, 1 egg (MCM). ST. JOHNS CO.: Lot 1045, 4 eggs (DHH). LARVAE:

FLORIDA: ALACHUA CO.: Lot 247, 1 larva (instar 1) (MCM); Lot 251, 9 larvae (instars 1, 2) (MCM). LEVY CO.: Lot 248, 11 larvae (instars 1, 2) (MCM); Lot 252, 5 larvae (instars 4, 5) (MCM). PUTNAM CO.: Lot 249, 1 larva (instar 5) (MCM); Lot 250, 1 larva (instar 4) (MCM); Lot 675, 1 larva (instar 5) (MCM); Lot 676, 6 larvae (instar 5) (MCM); Lot 677, 7 larvae (instars 3, 4) (MCM); Lot 997, 3 larvae (instars 4, 5) (MCM); Lot 1525, 3 larvae (instar 1) (MCM). ST. JOHNS CO.: Lot 1044, 1 larva (instar 1) (DHH); Lot 1046, 3 larvae (instar 1) (DHH). PUPAE: FLORIDA: LEVY CO.: Lot 252, 1 pupa (MCM). PUTNAM CO.: Lot 676, 2 pupae (MCM); Lot 997, 2 pupae (MCM).

167. *Hesperia meskei* (Edwards)

Diagnosis. EGG: height 1.4mm, width 0.9mm, polygonal sculpturing, white. LAST INSTAR LARVA: BODY: length 16-20mm, A4 transverse width 4.4-4.6mm; brown; some setae with expanded tips, < 0.1mm long on A4 dorsum; spiracles dark brown. HEAD: black with two pale lines parallel to the vertex; transverse width 3.6-3.8mm; sculpturing pitted; setae simple, < 0.1mm long at apex, a few ventral setae to 0.4mm; stemmata subequal (Figure 42B). THORAX: legs black; shield broad, black. ABDOMEN: prolegs each with about 95 crochets, irregularly triordinal, arranged in a circle; suranal plate rounded, unmarked.

Host Plants. POACEAE: *Andropogon scoparius* (McGuire 1982), *Aristida purpurascens* (McGuire 1982, associated with; Scott 1986), *Cynodon dactylon* (MCM collection, in lab).

Specimens Examined. EGGS: FLORIDA: DUVAL CO.: Lot 1043, 2 eggs (DHH). LARVAE: FLORIDA: PUTNAM CO.: Lot 994, 3 larvae (instars 3, 5) (MCM).

168. *Hesperia dacotae* (Skinner)

McCabe and Post (1977) and McCabe (1981) described the larva of this upper Great Plains species, but the only specimen that I could find for examination was a single first instar larva.

Host Plants. CYPERACEAE: *Carex* species (McCabe 1981, in lab).

POACEAE: *Andropogon gerardii* (McCabe 1981, in lab), *Andropogon scoparius* (Scott 1986), *Aristida* species (Pyle 1981), *Bouteloua* species (Pyle 1981), *Koeleria cristata* (McCabe 1981, in lab), *Panicum* species (Scott 1986), *Phleum pratense* (McCabe 1981, in lab), *Poa pratensis* (McCabe 1981, in lab), *Stipa spartea* (McCabe 1981, in lab).

Specimens Examined. LARVAE: MINNESOTA: FELTON CLAY CO.: Lot 543, 1 larva (instar 1) (TLM).

169. *Hesperia lindseyi* (Holland)

MacNeill (1964) described the egg, larva, and pupa of this western species, but I could not find specimens for study.

Host Plants. POACEAE: *Danthonia californica* (MacNeill 1964), *Festuca idahoensis* (MacNeill 1964), *Vulpia megalura* (Scott 1986).

170. *Hesperia sassacus* Harris

Scudder (1889a) described the egg and larva of this northeastern species, but I could not find specimens for study.

Host Plants. CYPERACEAE: *Carex varia* (Fletcher 1888, in lab).

POACEAE: *Agrostis vulgaris* (Fletcher 1888, in lab), *Andropogon scoparius* (McGuire 1982), *Danthonia spicata* (Fletcher 1888, in lab), *Digitaria sanguinalis* (Scudder 1889a,b), *Festuca obtusa* (Scott 1986), *Festuca paradoxa* (Shapiro 1974a), *Festuca rubra* (Opler and Krizek 1984), *Panicum* species (Scudder 1893), *Poa annua* (Shapiro 1966, possibly).

171. *Hesperia miriamae* MacNeill

Little is known of the biology of this high-altitude, western species. MacNeill (1975) briefly described the egg and listed the grass, *Andropogon scoparius*, as a host. McGuire (1982) corrected the host identification to *Festuca brachyphylla*.

172. *Hesperia nevada* (Scudder)

I could not locate eggs, last instar larvae, or pupae of this western, montane species for study. Figure 42C shows the stemmatal pattern of a fourth instar larva.

Other Descriptions. MacNeill 1964 (egg, larva), Emmel et al. 1992 (egg, larva).

Host Plants. POACEAE: *Festuca ovina* (Pyle 1981), *Koeleria* species (Scott and Scott 1980), *Poa pratensis* (MCM collection, in lab), *Sitanion hystrrix* (Emmel et al. 1971), *Stipa occidentalis* (MacNeill 1975).

Specimens Examined. LARVAE: COLORADO: TELLER CO.: Lot 253, 14 larvae (instars 1, 3, 4) (MCM).

173. *Polites coras* (Cramer)

Diagnosis. LAST INSTAR LARVA: BODY: length 18.5-25mm, A4 transverse width 3.8-4.6mm; brown with tiny dark spots, heart line darker brown, subdorsal line faint, brown; setae simple, to 0.4mm long on A4 dorsum; spiracles black. HEAD: Figure 30G, black with tan patches on upper face, two pale lines parallel to vertex, adfrontals mostly pale, a pale eye patch present; transverse width 2.6-3mm; sculpturing pitted; setae simple, to 0.2mm long at apex, a few ventral setae to 0.3mm; stemmata subequal (Figure 42D). THORAX: legs very dark brown; shield broad, dark brown. ABDOMEN: prolegs each with about 70 crochets, irregularly triordinal, arranged in a circle; suranal plate rounded with dark markings (Figure 51F). PUPA: Figures 70H and 91G, length 15-18mm, A3 transverse width 3.8-4.3mm; blackish brown, abdomen cream-colored; thoracic spiracle guard distinct; setae simple, to 0.8mm long on head; pilifers touching; head rounded; antennal tip lies far cephalad of tip of middle

leg; proboscis extending into A8; abdomen long; cremaster to 1.1mm long, bluntly pointed with numerous hooked setae in a cluster at the tip (Figures 107E and 119E); lenticles present on the prothorax and proleg scars.

Other Descriptions. Saunders 1869a (egg, young larva), Dethier 1940b (larva, pupa).

Host Plants. POACEAE: *Cynodon dactylon* (MCM collection, in lab), *Leersia oryzoides* (Shapiro 1974a).

Specimens Examined. LARVAE: MARYLAND: PRINCE GEORGE'S CO.: Lot 14, 6 larvae (instar 5); Lot 386, 2 larvae (instar 5) (MCM); Lot 388, 4 larvae (instar 5) (MCM). NEW YORK: Lot 650?, 1 larva (instar 4) (USNM). PUPAE: MARYLAND: PRINCE GEORGE'S CO.: Lot 14, 4 pupae (MCM); Lot 385, 6 pupae (MCM); Lot 386, 2 pupae (MCM); Lot 387, 5 pupae (MCM); Lot 388, 2 pupae (MCM).

174. *Polites sabuleti* (Boisduval)

Diagnosis. LAST INSTAR LARVA: BODY: length 15-25mm, A4 transverse width 2.9-4.5mm; green or brown, heart line darker, subdorsal line faint, dark, lateral line bounded by dark bands; setae simple, to 0.4mm long on A4 dorsum; spiracles dark brown. HEAD: Figure 30H, black, upper face tan with two pale lines parallel to vertex, adfrontals pale, a small pale eye patch present; transverse width 2.3-2.9mm; sculpturing pitted; setae simple, < 0.1mm long at apex, a few ventral setae to 0.4mm; stemmata subequal (Figure 42E). THORAX: legs very dark brown; shield broad, dark brown.

ABDOMEN: prolegs each with about 65 crochets, irregularly triordinal, arranged in a circle; suranal plate rounded with dark markings (Figures 51G and 52A). PUPA: Figures 71A and 91H, length 13-16mm, A3 transverse width 3.5-4mm; brown, abdomen cream-colored; thoracic spiracle guard distinct; setae simple, to 0.4mm long on head; pilifers touching; head rounded; antennae tip lies far cephalad of tip of middle leg; proboscis extending into A6; abdomen long; cremaster to 1mm long, bluntly pointed with numerous hooked setae in a cluster at the tip (Figures 107F and 119F); lenticles present on the prothorax, dorsal abdomen, and proleg scars.

Other Descriptions. Comstock 1929 (egg, young larva), Dethier 1944a (egg, larva, pupa), Newcomer 1966 (egg, larva, pupa), Emmel and Emmel 1973 (egg, larva, pupa).

Host Plants. CYPERACEAE: *Carex filifolia* (Lembert 1894) [oviposition substrate only]. FABACEAE: *Trifolium monanthum* (Lembert 1894) [oviposition substrate only]. POACEAE: *Agrostis scabra* (Shapiro 1977), *Cynodon dactylon* (Wright 1905), *Digitaria sanguinalis* (Tietz 1972), *Distichlis spicata* (Wright 1905, probably; Shapiro 1974b,c), *Distichlis spicata* var. *stricta* (Scott 1986), *Eragrostis trichodes* (Scott and Scott 1980), *Festuca brachyphylla* (McGuire 1982), *Festuca idahoensis* (Shapiro et al. 1981), *Poa pratensis* (Newcomer 1966, associated with; Scott 1986).

Specimens Examined. LARVAE: CALIFORNIA: NEVADA CO.: Lot 403, 14 larvae (instars 3, 4, 5) (MCM). ORANGE CO.: Lot

577, 1 larva (instar 5) (GRB). SACRAMENTO CO.: Lot 399, 1 larva (instar 3) (MCM); Lot 400, 6 larvae (instar 5) (MCM); Lot 401, 5 larvae (instar 5) (MCM); Lot 402, 4 larvae (instar 5) (MCM). PUPAE: CALIFORNIA: NEVADA CO.: Lot 403, 2 pupae (MCM). SACRAMENTO CO.: Lot 400, 2 pupae (MCM); Lot 401, 2 pupae (MCM); Lot 402, 4 pupae (MCM).

175. *Polites mardon* (Edwards)

Diagnosis. LAST INSTAR LARVA: BODY: length 19.5-21.5mm, A4 transverse width 3.7-4.2mm; preserved specimens brown; setae simple, to 0.2mm long on A4 dorsum; spiracles dark brown. HEAD: Figure 31A, black with pale patches on upper face, two pale lines parallel to the vertex, adfrontal mostly pale, a pale eye patch present; transverse width 2.6-2.8mm; sculpturing pitted; setae simple, to 0.1mm long at apex, a few ventral setae to 0.2mm; stemmata subequal (Figure 42F). THORAX: legs very dark brown; shield broad, dark brown. ABDOMEN: prolegs each with about 65 crochets, irregularly triordinal, arranged in a circle; suranal plate rounded with dark markings (Figure 52B). PUPA: Figures 71B and 92A, length 17mm, A3 transverse width 4-4.1mm; brown; thoracic spiracle guard distinct; setae simple, to 0.6mm long on head; pilifers touching; head rounded; antennae tip lies far cephalad of tip of middle leg; proboscis extending into A6; abdomen long; cremaster to 1mm long, bluntly pointed with numerous hooked setae in a cluster at the tip

(Figures 107G and 119G); lenticles present on the prothorax, dorsal abdomen, and proleg scars.

Other Descriptions. Newcomer 1966 (egg, larva, pupa).

Host Plants. POACEAE: *Bromus carinatus* (Newcomer 1966, probably), *Festuca idahoensis* (Pyle 1981, suspected), *Festuca ovina* (Newcomer 1966, probably), *Poa pratensis* (MCM collection, in lab).

Specimens Examined. LARVAE: CALIFORNIA: DEL NORTE CO.: Lot 391, 2 larvae (instar 5) (MCM), Lot 392, 4 larvae (instar 4) (MCM); Lot 576, 1 larva (instar 5) (GRB). PUPAE: CALIFORNIA: DEL NORTE CO.: Lot 391, 2 pupae (MCM).

176. *Polites draco* (Edwards)

Diagnosis. LAST INSTAR LARVA: BODY: length 17-22mm, A4 transverse width 3.3-4.8mm; brown, heart line darker brown, subdorsal line faint, dark, lateral line bounded by dark bands; setae simple, to 0.4mm long on A4 dorsum; spiracles dark brown. HEAD: Figure 31B, black with two pale lines parallel to vertex, adfrontals mostly pale; transverse width 2.1-3.1mm; sculpturing pitted; setae simple, to 0.2mm long at apex, a few ventral setae to 0.3mm; stemmata subequal (Figure 42G). THORAX: legs very dark brown; shield broad, black. ABDOMEN: prolegs each with about 70 crochets, irregularly triordinal, arranged in a circle; suranal plate rounded with dark markings (Figure 52C). PUPA: Figures 71C and 92B, length 14-26.5mm, A3 transverse width 3.6-4.8mm; dark brown, abdomen cream-colored; thoracic spiracle guard

distinct; setae simple, to 0.5mm long on head; pilifers touching; head rounded; antennal tip lies far cephalad of tip of middle leg; proboscis extending into A6; abdomen long; cremaster to 1.5mm long, bluntly pointed with numerous hooked setae in a cluster at the tip (Figures 107H and 119H); lenticles present on the prothorax, dorsal abdomen, and proleg scars.

Other Descriptions. Emmel et al. 1992 (larva, pupa).

Host Plants. POACEAE: *Poa pratensis* (MCM collection, in lab), *Poa* species (Emmel et al. 1992).

Specimens Examined. LARVAE: COLORADO: TELLER CO.: Lot 389, 7 larvae (instars 1, 2, 3, 5) (MCM); Lot 390, 12 larvae (instars 4, 5) (MCM). PUPAE: COLORADO: TELLER CO.: Lot 389, 2 pupae (MCM); Lot 390, 11 pupae (MCM).

177. *Polites baracoa* (Lucas)

Diagnosis. EGG: Figure 4E, height 0.9mm, width 0.6-0.7mm, polygonal sculpturing, white. LAST INSTAR LARVA: BODY: length 19mm, A4 transverse width 4.1mm; brown, heart line darker brown, subdorsal line dark brown, lateral line orange brown bounded by dark bands; some setae with expanded tips, < 0.1mm long on A4 dorsum; spiracles brown. HEAD: Figure 31C, black, upper face tan with dark pits, two pale lines parallel to vertex, adfrontals partly pale, front with two pale spots, a pale eye patch present; transverse width 2.1mm; sculpturing pitted; setae simple, < 0.1mm long at apex, a few ventral setae to 0.2mm; stemmata subequal

(Figure 42H). THORAX: legs dark brown; shield broad, black. ABDOMEN: prolegs each with about 70 crochets, irregularly triordinal, arranged in a circle; suranal plate rounded with three broad black longitudinal stripes convergent along the distal margin (Figure 52D). PUPA: Figures 71D and 92C, length 14-15.5mm, A3 transverse width 3.3-4.0mm; cream-colored with brown markings on the head and thorax; thoracic spiracle guard distinct; setae simple, to 0.3mm long on head; pilifers touching; head rounded; antennal tip lies far cephalad of tip of middle leg; proboscis extending into A6; abdomen long; cremaster to 1mm long, blunt with numerous hooked setae in a cluster at the tip (Figures 107I and 119I); lenticles present on the prothorax, dorsal abdomen, and proleg scars.

Other Descriptions. Dethier 1939b (egg, larva).

Host Plants. POACEAE: *Cynodon dactylon* (MCM collection, in lab), *Saccharum officinarum* (Dethier 1939b, in lab).

Specimens Examined. EGGS: FLORIDA: PUTNAM CO.: Lot 1527, 7 eggs (MCM). LARVAE: FLORIDA: BROWARD CO.: Lot 384, 9 larvae (instars 1, 5) (MCM). PUTNAM CO.: Lot 998, 1 larva (instar 5) (MCM). PUPAE: FLORIDA: BROWARD CO.: Lot 384, 11 pupae (MCM).

178. *Polites themistocles* (Latreille)

Diagnosis. EGG: height 1-1.1mm, width 0.6-0.8mm, polygonal sculpturing, pinkish. LAST INSTAR LARVA: BODY: length 19-30mm, A4 transverse width 3.9-5mm; green or brown, heart

line dark, subdorsal line faint, dark, lateral line bounded by dark bands; setae simple, < 0.1mm long on A4 dorsum; spiracles dark brown. HEAD: Figure 31D, black with two pale lines parallel to vertex, adfrontals mostly pale, or occasionally head uniformly black; transverse width 2.5-3mm; sculpturing rough; setae simple, < 0.1mm long at apex, a few ventral setae to 0.4mm; stemmata subequal (Figure 42I).

THORAX: legs dark brown; shield broad, dark brown.

ABDOMEN: prolegs each with about 90 crochets, irregularly triordinal, arranged in a circle; suranal plate rounded with dark markings (Figure 52E). PUPA: Figures 71E and 92D, length 14.5-24mm, A3 transverse width 3.8-5.1mm; green, abdomen cream-colored; thoracic spiracle guard distinct; setae simple, to 0.4mm long on head; pilifers touching; head rounded; antennal tip lies far cephalad of tip of middle leg; proboscis extending into A5; abdomen long; cremaster to 1.5mm long, bluntly pointed with numerous hooked setae in a cluster at the tip (Figures 107J and 119J); lenticles present on the prothorax, dorsal abdomen, and proleg scars.

Other Descriptions. Fletcher 1888 (egg, larva, pupa), Scudder 1889a (egg, larva, pupa), Fyles 1896 (larva), Laurent 1908 (egg, larva, pupa), Dethier 1938a (larva), Dethier 1942a (larva, pupa), Emmel et al. 1992 (egg, larva, pupa).

Host Plants. POACEAE: *Agropyron repens* (Fletcher 1888, in lab), *Cynodon dactylon* (MCM collection, in lab), *Digitaria*

filiformis (Opler and Krizek 1984), *Echinochloa crusgalli* (Fletcher 1888, in lab), *Eremochloa ophiurooides* (MCM collection), *Panicum aciculare* (Minno 1992), *Panicum clandestinum* (Shapiro 1966), *Phleum pratense* (Fletcher 1888, in lab), *Poa pratensis* (Scott 1986), *Poa* species (Stanford 1981).

Specimens Examined. EGGS: FLORIDA: ALACHUA CO.: Lot 1529, 11 eggs (MCM). LARVAE: COLORADO: FREMONT CO.: Lot 409, 7 larvae (instar 5) (MCM); Lot 410, 3 larvae (instars 1, 5) (MCM); Lot 411, 3 larvae (instar 5) (MCM). FLORIDA: ALACHUA CO.: Lot 413, 8 larvae (instar 5) (MCM); Lot 1529, 3 larvae (instar 1) (MCM). FLAGLER CO.: Lot 408, 2 larvae (instar 5) (MCM). HIGHLANDS CO.: Lot 412, 2 larvae (instar 2) (MCM). PUPAE: COLORADO: FREMONT CO.: Lot 409, 7 pupa (MCM); Lot 410, 1 pupa (MCM). FLORIDA: ALACHUA CO.: Lot 413. 4 pupae (MCM). FLAGLER CO.: Lot 408, 1 pupa (MCM). HIGHLANDS CO.: Lot 411, 2 pupae (MCM); Lot 412, 2 pupae (MCM).

179. *Polites origenes* (Fabricius)

Diagnosis. LAST INSTAR LARVA: BODY: length 23-30mm, A4 transverse width 4-5.4mm; brown, heart line darker brown, subdorsal line faint, dark; setae simple, < 0.1mm long on A4 dorsum; spiracles dark brown. HEAD: Figure 31E, uniformly black; transverse width 3-3.5mm; sculpturing rough to pitted; setae simple, < 0.1mm long at apex, a few ventral setae to 0.4mm; stemmata subequal (Figure 42J). THORAX:

legs dark brown; shield broad, dark brown. ABDOMEN: prolegs each with about 75 crochets, irregularly triordinal, arranged in a circle; suranal plate rounded with a few small dark spots (Figure 52F); wax glands forming a ventral transverse patch on A7-8. PUPA: Figures 71F and 92E, length 19-22.5mm, A3 transverse width 4.3-5.6mm; green, abdomen cream-colored; thoracic spiracle guard distinct; setae simple, to 0.5mm long on head; pilifers touching; head rounded; antennal tip lies far cephalad of tip of middle leg; proboscis extending into A7; abdomen long; cremaster to 1.7mm long, bluntly pointed with numerous hooked setae in a cluster at the tip (Figures 107K and 119K); lenticles present on the prothorax, dorsal abdomen, and proleg scars.

Other Descriptions. Scudder 1889a (egg, larva), Laurent 1892 (egg, larva, pupa), Laurent 1908 (egg), Dethier 1938a (egg, young larva), Dethier 1941 (larva).

Host Plants. POACEAE: *Andropogon scoparius* (Scott 1986), *Cynodon dactylon* (MCM collection, in lab), *Poa pratensis* (MCM collection, in lab), *Tridens flavus* (Shapiro 1966).

Specimens Examined. LARVAE: COLORADO: EL PASO CO.: Lot 394, 2 larvae (instars 3, 4) (MCM); Lot 395, 5 larvae (instar 5) (MCM); Lot 396, 5 larvae (instar 5) (MCM).

MARYLAND: PRINCE GEORGE'S CO.: Lot 397, 2 larvae (instar 5) (MCM). PENNSYLVANIA: CAMBRIA CO.: Lot 398, 4 larvae (instar 3) (MCM). PUPAE: COLORADO: EL PASO CO.: Lot 395,

4 pupae (MCM); Lot 396, 2 pupae (MCM). MARYLAND: PRINCE GEORGE'S CO.: Lot 397, 4 pupae (MCM).

180. *Polites mystic* (Edwards)

Diagnosis. LAST INSTAR LARVA: BODY: length 14-27.5mm, A4 transverse width 3.1-5.1mm; brown, heart line darker brown; setae simple, to 0.1mm long on A4 dorsum; spiracles black. HEAD: Figure 31F, uniformly black; transverse width 2.2-3mm; sculpturing rough to pitted; setae simple, to 0.1mm long at apex, a few ventral setae to 0.2mm; stemmata subequal (Figure 42K). THORAX: legs dark brown; shield broad, black. ABDOMEN: prolegs each with about 65 crochets, irregularly triordinal, arranged in a circle; suranal plate rounded with a few small dark spots (Figure 53A). PUPA: Figures 71G and 92F, length 20mm, A3 transverse width 4.8mm; dark brown; thoracic spiracle guard distinct; setae simple, to 0.5mm long on head; pilifers touching; head rounded; antennal tip lies far cephalad of tip of middle leg; proboscis extending into A7; abdomen long; cremaster to 1.8mm long, bluntly pointed with numerous hooked setae in a cluster at the tip (Figures 107L and 120A); lenticles present on the prothorax and proleg scars.

Other Descriptions. Saunders 1869a (egg, larva), Fyles 1896 (larva), Laurent 1908 (egg, larva), Dethier 1938a (egg, young larva), Dethier 1940c (larva, pupa).

Host Plants. CYPERACEAE: *Carex* species (Tietz 1972) [oviposition substrate only]. POACEAE: *Agropyron repens*

(Tietz 1952), *Bromus inermis* (TLM collection), *Cynodon dactylon* (MCM collection, in lab), *Echinochloa crusgalli* (Tietz 1952), *Festuca idahoensis* (MacNeill 1975, possibly), *Phleum pratense* (Tietz 1952), *Poa pratensis* (MCM collection, in lab), *Poa* species (Shapiro 1966).

Specimens Examined. LARVAE: NEW YORK: BROOME CO.: Lot 393, 3 larvae (instars 3, 5) (MCM). NORTH DAKOTA: CASS CO.: Lot 549, 1 larva (instar 4) (TLM). PUPAE: USA: NEW YORK: BROOME CO.: Lot 393, 1 pupa (MCM).

181. *Polites sonora* (Scudder)

Diagnosis. LAST INSTAR LARVA: BODY: length 17-23.5mm, A4 transverse width 3.8-4.8mm; brown, heart line darker brown; setae simple, < 0.1mm long on A4 dorsum; spiracles dark brown. HEAD: Figure 31G, uniformly dark brown; transverse width 2.6-2.8mm; sculpturing rough to pitted; setae simple, < 0.1mm long at apex, a few ventral setae to 0.4mm; stemmata subequal (Figure 42L). THORAX: legs dark brown; shield dark brown. ABDOMEN: prolegs each with about 65 crochets, irregularly triordinal, arranged in a circle or near circle; suranal plate rounded with a few small dark spots (Figure 53B). PUPA: Figures 71H and 92G, length 15.5-17mm, A3 transverse width 3.6-4.1mm; blackish, abdomen brown; thoracic spiracle guard distinct; setae simple, to 0.3mm long on head; pilifers touching; head rounded; antennal tip lies far cephalad of tip of middle leg; proboscis extending into A7; abdomen long; cremaster to 1.3mm long, bluntly

pointed with numerous hooked setae in a cluster at the tip (Figures 107M and 120B); lenticles present on the prothorax and dorsal abdomen.

Other Descriptions. Newcomer 1966 (egg, young larva), Emmel et al. 1992 (egg, larva, pupa).

Host Plants. POACEAE: *Festuca idahoensis* (Newcomer 1966, associated with); *Poa pratensis* (MCM collection, in lab).

Specimens Examined. LARVAE: CALIFORNIA: SAN BERNARDINO CO.: Lot 407, 1 larva (instar 5) (MCM). COLORADO: TELLER CO.: Lot 404, 7 larvae (instar 5) (MCM); Lot 405, 7 larvae (instar 5) (MCM); Lot 406, 7 larvae (instars 1, 4, 5) (MCM). PUPAE: COLORADO: TELLER CO.: Lot 404, 3 pupae (MCM); Lot 405, 5 pupae (MCM).

182. *Polites vibex* (Geyer)

Diagnosis. EGG: Figures 3D and 5B, height 0.9-1mm, width 0.6-0.7mm, polygonal sculpturing, white. LAST INSTAR LARVA: BODY: length 15-27.5mm, A4 transverse width 4-5mm; green, heart line dark; some setae with blunt to slightly expanded tips, < 0.1mm long on A4 dorsum; spiracles black. HEAD: Figure 31H, mostly light brown with dark pits, two pale lines parallel to vertex, adfrontals pale, front with two pale spots, a pale eye patch present; transverse width 2.6-3mm; sculpturing rough to pitted; setae simple, < 0.1mm long at apex, a few ventral setae to 0.3mm; stemmata subequal (Figure 42M). THORAX: T1 legs dark brown, T2-3 legs pale; shield broad, dark brown. ABDOMEN: prolegs each with about

105 crochets, irregularly triordinal, arranged in a circle; suranal plate rounded with a few black spots (Figure 53C); wax glands forming ventral transverse patches on A7-8.

PUPA: Figures 72A and 92H, length 18-21mm, A3 transverse width 4.2-5.3mm; green; thoracic spiracle guard distinct; setae simple, to 0.5mm long on head; pilifers touching; head rounded; antennal tip lies far cephalad of tip of middle leg; proboscis extending to the cremaster; abdomen moderately long; cremaster to 1.2mm long, bluntly pointed with numerous hooked setae in a cluster at the tip (Figures 107N and 120C); lenticles present on the prothorax, dorsal abdomen, and proleg scars.

Other Descriptions. Edwards and Chapman 1879 (egg, larva, pupa), Minno and Emmel 1993 (larva, pupa).

Host Plants. POACEAE: *Cynodon dactylon* (Kendall 1965), *Digitaria villosa* (MCM collection), *Paspalum ciliatifolium* (Scudder 1889a,b), *Paspalum setaceum* (Edwards and Chapman 1879), *Stenotaphrum secundatum* (Kendall 1965).

Specimens Examined. EGGS: FLORIDA: ALACHUA CO.: Lot 1528, 7 eggs (MCM). NASSAU CO.: Lot 1537, 1 egg (MCM). FLORIDA: ALACHUA CO.: Lot 415, 12 larvae (instar 2) (MCM); Lot 417, 1 larva (instar 5) (MCM); Lot 418, 7 larvae (instar 5) (MCM); Lot 1038, 1 larva (instar 5) (DHH); Lot 1080, 1 larva (instar 4) (DHH); Lot 1528, 7 larvae (instar 1) (MCM). BROWARD CO.: Lot 419, 1 larva (instar 5) (MCM); Lot 421, 6 larvae (instar 5) (MCM); Lot 422, 1 larva (instar 5) (MCM).

LEVY CO.: Lot 1079, 1 larva (instar 4) (DHH). PUPAE: FLORIDA: ALACHUA CO.: Lot 418, 4 pupae (MCM); Lot 422, 5 pupae (MCM). BROWARD CO.: Lot 421, 6 pupae (MCM).

183. *Wallengrenia otho* (J. E. Smith)

Diagnosis. LAST INSTAR LARVA: BODY: length 16-25mm, A4 transverse width 3.8-4.8mm; pinkish brown, heart line dark, lateral line pale orange, well-developed on thorax, fading out on abdomen; setae simple, to 0.1mm long on A4 dorsum; spiracles tan. HEAD: Figure 32A, uniformly black; transverse width 2.7-2.9mm; sculpturing rough; setae simple, to 0.1mm long at apex, a few ventral setae to 0.3mm; stemmata subequal (Figure 42N). THORAX: legs dark brown; shield broad, black. ABDOMEN: prolegs each with about 90 crochets, irregularly triordinal, arranged in a circle; suranal plate rounded, unmarked (Figure 53D). PUPA: Figures 72B and 93A, length 17-21mm, A3 transverse width 4.1-4.8mm; cream-colored; thoracic spiracle guard distinct; setae simple, to 0.6mm long on head; pilifers touching; head rounded; antennal tip lies far cephalad of tip of middle leg; proboscis extending into A7; abdomen long; cremaster to 1.3mm long, bluntly pointed with numerous hooked setae in a cluster at the tip (Figures 1070 and 120D); lenticles present on the prothorax, dorsal abdomen, and proleg scars.

Other Descriptions. Minno and Emmel 1993 (larva).

Host Plants. GENTIANACEAE: *Sabatia brevifolia* (Scudder 1881) [erroneous], *Sabatia campanulata* (Tietz 1952)

[erroneous]. POACEAE: *Digitaria sanguinalis* (Scudder 1889a,b), *Eleusine indica* (MCM collection), *Oryza sativa* (Riley 1975), *Panicum* species (Lenczewski 1980), *Paspalum caespitosum* (Minno and Emmel 1993), *Paspalum* species (Lenczewski 1980), *Saccharum officinarum* (Riley 1975), *Stenotaphrum secundatum* (Kendall 1960, in lab).

Specimens Examined. EGGS: FLORIDA: LAKE CO.: Lot 1530, 1 egg (MCM). LARVAE: FLORIDA: COLLIER CO.: Lot 525, 1 larva (instar 4) (MCM). MONROE CO.: Lot 526, 1 larva (instar 5) (MCM); Lot 527, 8 larvae (instars 3, 5) (MCM). TEXAS: COMAL CO.: Lot 990, 3 larvae (instars 4, 5) (ROK). PUPAE: FLORIDA: MONROE CO.: Lot 527, 3 pupae (MCM); Lot 990, 1 pupa (ROK).

184. *Wallengrenia egeremet* (Scudder)

Diagnosis. LAST INSTAR LARVA: BODY: Figure 20G, length 24-26.5mm, A4 transverse width 4.5-4.8mm; pinkish brown, heart line dark, lateral line very pale orange, well-developed on thorax, fading out on abdomen; setae simple, to 0.2mm long on A4 dorsum; spiracles tan. HEAD: uniformly black; transverse width 2.8-2.9mm; sculpturing rough; setae simple, to 0.1mm long at apex, a few ventral setae to 0.3mm; stemmata subequal (Figure 420). THORAX: legs dark brown; shield broad, black. ABDOMEN: prolegs each with about 90 crochets, irregularly triordinal, arranged in a circle; suranal plate rounded, unmarked. PUPA: Figures 72C and 93B, length 18-20mm, A3 transverse width 4.6-5mm; cream-

colored; thoracic spiracle guard distinct; setae simple, to 0.6mm long on head; pilifers touching; head rounded; antennal tip lies far cephalad of tip of middle leg; proboscis extending into A8; abdomen long; cremaster to 1.3mm long, blunt with numerous hooked setae in a cluster at the tip (Figures 107P and 120E); lenticles present on the prothorax, dorsal abdomen, and proleg scars.

Other Descriptions. Scudder 1889a (egg, larva, pupa), Laurent 1908 (egg, larva), Dethier 1938a (egg, larva). Until relatively recently, this species and *W. otho* were considered to be conspecific, thus some of these descriptions may actually refer to the latter.

Host Plants. GENTIANACEAE: *Sabatia gracilis* (Hayward 1947) [erroneous]. IRIDACEAE: *Sisyrinchium* species (Draudt 1924) [erroneous]. POACEAE: *Digitaria sanguinalis* (Duffy and Garland 1978), *Panicum clandestinum* (Shapiro 1966), *Panicum dichotomum* (Shapiro 1974a), *Paspalum setaceum* (MCM collection, in lab).

Specimens Examined. LARVAE: FLORIDA: ALACHUA CO.: Lot 523, 6 larvae (instars 4, 5) (MCM); Lot 524, 3 larvae (instars 4, 5) (MCM). PUPAE: FLORIDA: ALACHUA CO.: Lot 523, 2 pupae (MCM); Lot 524, 2 pupae (MCM).

185. *Pompeius verna* (Edwards)

Diagnosis. LAST INSTAR LARVA: BODY: Figure 20F, length 22-24mm, A4 transverse width 4.3-4.7mm; green, heart line dark; setae simple, to 0.1mm long on A4 dorsum; spiracles

dark brown. HEAD: Figure 32B, uniformly black, shiny; transverse width 3mm; sculpturing pitted to rough; setae simple, to 0.1mm long at apex, a few ventral setae to 0.5mm; stemmata subequal (Figure 42P). THORAX: T1 legs black, T2-3 legs pale; shield broad, black. ABDOMEN: prolegs each with about 85 crochets, irregularly triordinal, arranged in a mesal penellipse; suranal plate rounded, unmarked (Figure 53E). PUPA: Figures 59B, 72D, and 93C, length 20.5-21mm, A3 transverse width 4.3-4.5mm; cream-colored, head and dorsum of thorax black, wing veins outlined with dark brown, cremaster black; thoracic spiracle guard distinct; setae simple, to 0.8mm long on head; pilifers touching; head rounded; antennal tip lies far cephalad of tip of middle leg; proboscis extending into A6; abdomen long; cremaster to 1.7mm long, squarish with small irregularly sized teeth along distal margin, numerous stiff setae in a row along distal margin (Figures 108A and 120F); lenticles present on prothorax, dorsal abdomen, and proleg scars.

Other Descriptions. Scudder 1889a (egg, larva), Laurent 1908 (egg, larva), Dethier 1939a (egg, young larva).

Host Plants. POACEAE: *Cynodon dactylon* (MCM collection, in lab), *Erianthus alopecuroides* (Tietz 1952), *Panicum* species (Stanford 1981), *Tridens flavus* (Shapiro 1966).

Specimens Examined. LARVAE: PENNSYLVANIA: CAMBRIA CO.: Lot 432, 24 larvae (instars 3, 4) (MCM); Lot 433, 2 larvae

(instar 5) (MCM). PUPAE: PENNSYLVANIA: CAMBRIA CO.: Lot 433, 2 pupae (MCM).

186. *Atalopedes campestris* (Boisduval)

Diagnosis. EGG: Figure 5A, height 0.9-1mm, width 0.6-0.7mm, polygonal sculpturing, white. LAST INSTAR LARVA: BODY: length 18-40mm, A4 transverse width 3.5-6mm; brown, heart line dark; some setae with blunt or expanded tips, < 0.1mm long on A4 dorsum; spiracles black. HEAD: Figure 32C, black with two pale lines parallel to vertex, adfrontals mostly pale, front black; transverse width 2.7-3.7mm; sculpturing pitted to rough; setae simple, < 0.1mm long at apex, a few ventral setae to 0.4mm; stemmata subequal (Figure 42Q). THORAX: T1-2 legs dark brown, T3 legs brown; shield broad, dark brown. ABDOMEN: prolegs each with about 95 crochets, irregularly triordinal, arranged in a circle; suranal plate rounded with a few small dark spots (Figure 53F); wax glands forming ventral transverse patches on A7-8. PUPA: Figures 72E and 93D, length 18-22.5mm, A3 transverse width 4.3-5.83mm; brown, abdomen cream-colored with brown spots; thoracic spiracle guard distinct; setae simple, to 0.4mm long on head; pilifers touching; head rounded; antennal tip lies far cephalad of tip of middle leg; proboscis extending into A6; abdomen long; cremaster to 1.6mm long, bluntly pointed with numerous hooked setae in a cluster at the tip (Figures 108B

and 120G); lenticles present on the prothorax, dorsal abdomen, and proleg scars.

Other Descriptions. Scudder 1889a (egg, larva, pupa), Comstock 1929 (egg, larva, pupa), Emmel and Emmel 1973 (egg, larva, pupa), Emmel et al. 1992 (larva, pupa), Minno and Emmel 1993 (egg, larva, pupa).

Host Plants. POACEAE: *Cynodon dactylon* (Scudder 1889a,b), *Digitaria sanguinalis* (Tietz 1972), *Distichlis spicata* (Tietz 1952), *Eleusine indica* (Shapiro 1966), *Festuca rubra* (Scott 1986), *Imperata cylindrica* (Bryson 1985), *Poa pratensis* (Garth and Tilden 1986), *Stenotaphrum secundatum* (Kendall 1960).

Specimens Examined. EGGS: FLORIDA: ALACHUA CO.: Lot 1526, 13 eggs (MCM). LARVAE: CALIFORNIA: SAN BERNARDINO CO.: Lot 574, 1 larva (instar 5) (GRB). YOLO CO.: Lot 74, 10 larvae (instars 2, 5) (MCM); Lot 81, 5 larvae (instar 5) (MCM); Lot 82, 4 larvae (instar 5) (MCM). FLORIDA: ALACHUA CO.: Lot 75, 4 larvae (instar 5) (MCM); Lot 77, 3 larvae (instar 5) (MCM); Lot 78, 3 larvae (instar 5) (MCM); Lot 1526, 8 larvae (instar 1) (MCM). BROWARD CO.: Lot 76, 3 larvae (instar 5) (MCM); Lot 79, 3 larvae (instar 5) (MCM). DADE CO.: Lot 651, 3 larvae (instar 5) (MCM). LEVY CO.: Lot 65, 1 larva (instar 2) (MCM); Lot 66, 9 larvae (instar 5) (MCM); Lot 67, 7 larvae (instar 5) (MCM); Lot 68, 6 larvae (instar 5) (MCM); Lot 69, 8 larvae (instar 5) (MCM); Lot 71, 1 larva (instar 5) (MCM); Lot 1029, 1 larva (instar

5) (DHH). NEW MEXICO: HIDALGO CO.: Lot 786, 2 larvae (instar 5) (USNM). TEXAS: EDWARDS CO.: Lot 785, 5 larvae (instars 4, 5) (USNM). PUPAE: CALIFORNIA: YOLO CO.: Lot 81, 2 pupae (MCM); Lot 82, 2 pupae (MCM). FLORIDA: ALACHUA CO.: Lot 75, 2 pupae (MCM); Lot 77, 2 pupae (MCM); Lot 78, 2 pupae (MCM). BROWARD CO.: Lot 76, 3 pupae (MCM); Lot 79, 2 pupae (MCM). LEVY CO.: Lot 70, 6 pupae (MCM); Lot 71, 6 pupae (MCM); Lot 72, 6 pupae (MCM); Lot 73, 8 pupae (MCM). TEXAS: EDWARDS CO.: Lot 785, 1 pupa (USNM).

187. *Atrytone arogos* (Boisduval and Leconte)

Diagnosis. LAST INSTAR LARVA: BODY: length 20-29mm, A4 transverse width 2.8-3.7mm; green; setae simple, to 0.2mm long on A4 dorsum; spiracles tan. HEAD: Figure 32D, pale, medial, epicranial, and lateral lines light brown, epicranial line interrupted midway, separate from medial line; transverse width 2.3-2.8mm; sculpturing slightly rough; setae simple, < 0.1mm long at apex, a few ventral setae to 0.3mm; stemma 6 small (Figure 42R). THORAX: legs pale; shield narrow, a dark line between the annuli. ABDOMEN: prolegs each with about 90 crochets, irregularly triordinal, arranged in a near circle; suranal plate rounded, unmarked (Figure 53G). PUPA: Figures 72G and 94A, length 15mm, A3 transverse width 3.1mm; cream-colored, head and prothorax black; thoracic spiracle guard distinct; setae simple, to 0.2mm long on head; pilifers touching; head rounded; antennal tip lies far cephalad of tip of middle

leg; proboscis extending to A5; abdomen moderately long; cremaster to 0.8mm long, rounded without hooked setae (Figures 108C and 120H); lenticles present on the prothorax, dorsal abdomen, and proleg scars.

Other Descriptions. Heitzman 1966 (egg, larva, pupa).

Host Plants. POACEAE: *Andropogon gerardii* (Heitzman 1966), *Andropogon glomeratus* (Shapiro and Shapiro 1973, in lab), *Andropogon scoparius* (Shapiro and Shapiro 1973), *Panicum* species (Scudder 1872), *Sorghastrum secundum* (MCM collection).

Specimens Examined. LARVAE: FLORIDA: DUVAL CO.: Lot 95, 1 larva (instar 4) (MCM); Lot 652, 4 larvae (instars 3, 5) (MCM); Lot 653, 1 larva (instar 5) (MCM). PUPAE: FLORIDA: DUVAL CO.: Lot 94, 1 pupa (MCM).

188. *Atrytone delaware* (Edwards)

Diagnosis. EGG: Figures 3F and 4F, height 1-1.2mm, width 0.5-0.8mm, polygonal sculpturing, green with a red ring. LAST INSTAR LARVA: BODY: Figure 21A, length 21-38mm, A4 transverse width 3.7-5.4mm; bluish green, heart line slightly dark; setae simple, to 0.3mm long on A4 dorsum; spiracles tan. HEAD: Figure 32E, pale, medial, epicranial, and lateral lines broad, black; transverse width 2.7-3.2mm; setae simple, to 0.2mm long at apex, a few ventral setae to 0.6mm; stemmata subequal (Figure 42S). THORAX: T1 legs dark brown, T2-3 legs pale; shield broad, black. ABDOMEN: prolegs each with about 115 crochets, irregularly

triordinal, arranged in a circle or near circle; suranal plate rounded, distal margin black and a black transverse crescent (Figure 54A). PUPA: Figures 72F and 94B, length 18-25mm, A3 transverse width 3.7-5mm; cream-colored, head and prothorax black; thoracic spiracle guard distinct; setae simple, to 0.5mm long on head; pilifers touching; head rounded; antennal tip lies far cephalad of tip of middle leg; proboscis extending beyond the cremaster; abdomen long; cremaster to 2mm long with a downward pointing spine at the tip, hooked setae absent (Figures 108D and 120I); lenticles present on the prothorax, dorsal abdomen, and proleg scars.

Other Descriptions. Edwards and Chapman 1879 (larva, pupa).

Host Plants. POACEAE: *Andropogon gerardii* (McCabe and Post 1977), *Andropogon* species (Shapiro 1966), *Erianthus alopecuroides* (Edwards and Chapman 1879), *Erianthus giganteus* (MCM collection), *Panicum hemitomon* (Minno 1992), *Panicum rigidulum* (MCM observation), *Panicum virgatum* (Shapiro 1966), *Sorghastrum nutans* (MCM observation), *Sorghastrum secundum* (MCM collection).

Specimens Examined. EGGS: FLORIDA: ALACHUA CO.: Lot 1518, 25 eggs (MCM). LARVAE: FLORIDA: ALACHUA CO.: Lot 102, 1 larva (instar 4) (MCM); Lot 658, 1 larva (instar 4) (MCM); Lot 1030, 1 larva (instar 3) (DHH); Lot 1031, 1 larva (instar 5) (DHH); Lot 1032, 1 larva (instar 5) (DHH); Lot 1518, 8 larvae (instar 1) (MCM). BROWARD CO.: Lot 107, 1 larva (instar 4) (MCM); Lot 108, 1 larva (instar 4) (MCM).

DUVAL CO.: Lot 656, 1 larva (instar 5) (MCM). HIGHLANDS CO.: Lot 10, 1 larva (instar 5) (MCM); Lot 98, 1 larva (instar 5) (MCM); Lot 99, 2 larvae (instars 3, 5) (MCM); Lot 100, 5 larvae (instar 1) (MCM); Lot 655, 1 larva (instar 5) (MCM). LEVY CO.: Lot 113, 2 larvae (instar 4) (MCM); Lot 114, 1 larva (instar 5) (MCM). MARION CO.: Lot 103, 2 larvae (instar 5) (MCM); Lot 110, 2 larvae (instar 5) (MCM). PUTNAM CO.: Lot 101, 2 larvae (instar 5) (MCM); Lot 111, 1 larva (instar 4) (MCM); Lot 654, 1 larva (instar 5) (MCM). SARASOTA CO.: Lot 106, 2 larvae (instar 5) (MCM). SOUTH CAROLINA: BEAUFORT CO.: Lot 112, 1 larva (instar 5) (MCM). PUPAE: FLORIDA: ALACHUA CO.: Lot 109, 1 pupa (MCM). DUVAL CO.: Lot 97, 1 pupa (MCM); Lot 115, 1 pupa (MCM). HIGHLANDS CO.: Lot 99, 4 pupae (MCM); Lot 117, 1 pupa (MCM). LEVY CO.: Lot 105, 1 pupa (MCM); Lot 116, 1 pupa (MCM).

189. *Problema byssus* (Edwards)

Diagnosis. EGG: Figure 4G, height 1.4-1.6mm, width 1mm, polygonal sculpturing, white. LAST INSTAR LARVA: BODY: Figure 21B, length 24-43.5mm, A4 transverse width 4.5-6.2mm; bluish green with a yellowish cast to the thorax and posterior segments, heart line dark; setae simple, to 0.3mm long on A4 dorsum; spiracles tan. HEAD: Figure 32F, pale, medial, epicranial, and lateral lines broad, black, front with a few black stripes, epicranial line largely separate from medial line, sometimes with some small lateral

connections, posterior of head black; transverse width 2.8-3.8mm; sculpturing rough; setae simple, to 0.2mm long at apex, a few ventral setae to 0.5mm; stemmata subequal (Figure 42T). THORAX: T1 legs tan to brown, T2-3 legs pale; shield moderately broad, black. ABDOMEN: prolegs each with about 165 crochets, irregularly triordinal, arranged in a near circle; suranal plate rounded, unmarked (The suranal plate of earlier instars is mostly black or bears a black crescent.) (Figures 54B and C); wax glands forming ventral transverse patches on A7-8 (Figure 15A). PUPA: Figures 72H and 94C, length 26-28.5mm, A3 transverse width 5.5-6.3mm; cream-colored with brown markings on the head and thorax; thoracic spiracle guard distinct; setae simple, to 0.4mm long on head; pilifers touching; head rounded; antennal tip lies cephalad of tip of middle leg; proboscis extending into A5; abdomen long; cremaster to 2.1mm long, bluntly pointed with numerous hooked setae in a cluster at the tip (Figures 108E and 120J); lenticles present on the prothorax, dorsal abdomen, and proleg scars.

Other Descriptions. Heitzman 1965b (egg, larva, pupa).

Host Plants. POACEAE: *Andropogon gerardii* (Scott 1986), *Chasmanthium sessiliflorum* (MCM collection), *Erianthus alopecuroides* (MCM collection), *Erianthus giganteus* (MCM collection), *Tripsacum dactyloides* (Heitzman 1965a).

Specimens Examined. EGGS: FLORIDA: PUTNAM CO.: Lot 1521, 2 eggs (MCM). LARVAE: GEORGIA: HARRIS CO.: Lot 7, 2

larvae (instar 5) (MCM). FLORIDA: ALACHUA CO.: Lot 435, 1 larva (instar 5) (MCM); Lot 437, 1 larva (instar 5) (MCM); Lot 442, 2 larvae (instars 3, 4) (MCM); Lot 443, 3 larvae (instars 3, 5) (MCM); Lot 1069, 1 larva (instar 4) (DHH). DUVAL CO.: Lot 1068, 1 larva (instar 4) (DHH). FLAGLER CO.: Lot 440, 1 larva (instar 3) (MCM). LAKE CO.: Lot 441, 4 larvae (instars 2, 3) (MCM); Lot 444, 1 larva (instar 5) (MCM); Lot 445, 3 larvae (instar 5) (MCM); Lot 446, 5 larvae (instars 3, 5) (MCM); Lot 447, 3 larvae (instar 5) (MCM). LEVY CO.: Lot 438, 2 larvae (instars 3, 4) (MCM). MISSOURI: JACKSON CO.: Lot 566, 3 larvae (instar 5) (JRH). SOUTH CAROLINA: GEORGETOWN CO.: Lot 436, 2 larvae (instar 5) (MCM). PUPAE: FLORIDA: ALACHUA CO.: Lot 435, 1 pupa (MCM); Lot 443, 2 pupae (MCM). LAKE CO.: Lot 444, 1 pupa (MCM). GEORGIA: HARRIS CO.: Lot 7, 1 pupa (MCM).

190. *Problema bulenta* (Boisduval and Leconte)
Cromartie and Schweitzer (1993) described the egg and larva of this species, but I could not find specimens for study.

Host Plants. POACEAE: *Phragmites australis*, *Spartina alterniflora* (Cromartie and Schweitzer 1993, possibly), *Spartina cynosuroides* (Cromartie and Schweitzer 1993), *Zizaniopsis miliacea* (Opler and Krizek 1984, associated with).

191. *Ochlocles sylvanoides* (Boisduval)

Diagnosis. LAST INSTAR LARVA: BODY: length 20-24mm, A4 transverse width 4.4-5.1mm; preserved specimens pale; setae simple, to 0.2mm long on A4 dorsum; spiracles tan. HEAD: Figure 32G, pale, medial and lateral lines black, front pale, posterior of head black; transverse width 2.4-2.8mm; sculpturing slightly rough; setae simple, to 0.2mm long at apex, a few ventral setae to 0.6mm; stemmata subequal (Figure 42U). THORAX: legs pale; shield narrow, a dark line between the annuli. ABDOMEN: prolegs each with about 75 crochets, irregularly triordinal, arranged in a near circle; suranal plate rounded with a few small black spots. PUPA: Figures 73A and 94D, length 16-28mm, A3 transverse width 3.5-4.3mm; cream-colored; thoracic spiracle guard distinct; setae simple, to 0.4mm long on head; pilifers touching; head rounded; antennal tip lies cephalad of tip of middle leg; proboscis extending into A5; abdomen moderately long; cremaster to 1.5mm long, bluntly pointed with numerous hooked setae in a cluster at the tip (Figures 108F and 121A); lenticles present on the prothorax, dorsal abdomen, and proleg scars.

Other Descriptions. Comstock 1929 (larva, pupa), Comstock 1930a (egg), Emmel and Emmel 1973 (larva, pupa).

Host Plants. POACEAE: *Agropyron caninum* ssp. *majus* (Scott 1986), *Cynodon dactylon* (Scott 1986), *Elymus cinereus* (Scott

1986), *Elymus glaucus* (MCM collection), *Phalaris californica* (Shapiro 1974b), *Phalaris lemmoni* (Shapiro 1974b).

Specimens Examined. LARVAE: CALIFORNIA: RIVERSIDE CO.: Lot 344, 1 larva (instar 5) (MCM); Lot 704, 3 larvae (instar 5) (MCM). PUPAE: CALIFORNIA: RIVERSIDE CO.: Lot 704, 2 pupae (MCM).

192. *Ochlocetes agricola* (Boisduval)

Diagnosis. LAST INSTAR LARVA: BODY: length 19.5mm, A4 transverse width 4.1mm; preserved specimen pale; setae simple, to 0.1mm long on A4 dorsum; spiracles tan. HEAD: Figure 32H, pale, medial and lateral lines black, posterior of head black; transverse width 2.6mm; sculpturing rough to pitted; setae simple, to 0.2mm long at apex, a few ventral setae to 0.6mm; stemmata subequal (Figure 42V). THORAX: legs pale; shield narrow, a dark line between the annuli. ABDOMEN: prolegs each with about 75 crochets, irregularly triordinal, arranged in a near circle; suranal plate rounded, unmarked; wax glands forming two ventrolateral spots on A7-8 (Figure 15F).

Other Descriptions. Comstock 1927a (egg, young larva), Comstock 1930a (egg), Emmel and Emmel 1973 (egg, larva).

Specimens Examined. LARVAE: CALIFORNIA: SOLANO CO.: Lot 343, 1 larva (instar 5) (MCM).

193. *Ochlocetes snowi* (Edwards)

The immature stages of this western species are undescribed, and I could not find specimens for study.

Host Plants. POACEAE: *Blepharoneuron tricholepis* (Scott and Scott 1980).

194. *Ochlocles yuma* (Edwards)

Diagnosis. LAST INSTAR LARVA: BODY: length 32-35mm, A4 transverse width 4.7-5.7mm; preserved specimens pale; setae simple, < 0.1mm long on A4 dorsum; spiracles tan. HEAD: Figure 33A, pale, medial and lateral lines black, posterior of head black; transverse width 3-3.3mm; sculpturing slightly rough; setae simple, to 0.2mm long at apex, a few ventral setae to 0.5mm; stemmata subequal (Figure 42W). THORAX: legs pale; shield narrow, a dark line between the annuli. ABDOMEN: prolegs each with about 135 crochets, irregularly triordinal, arranged in a near circle; suranal plate rounded with some tiny dark spots (Figure 54D).

Other Descriptions. Emmel and Emmel 1973 (egg, pupa), MacNeill 1975 (egg, larva, pupa).

Host Plants. POACEAE: *Phragmites australis* (Tilden 1965).

Specimens Examined. LARVAE: CALIFORNIA: INYO CO.: Lot 345, 2 larvae (instar 5) (MCM).

195. *Poanes massasoit* (Scudder)

Laurent (1908) described the egg and young larva of this northeastern species, but I could not find specimens for study.

Host Plants. CYPERACEAE: *Carex aquatilis* (Layberry et al. 1982, probably), *Carex stricta* (Shapiro and Shapiro 1973,

probably; Shapiro 1974a). POACEAE: (Pyle 1981) [erroneous].

196. *Poanetes hobomok* (Harris)

Diagnosis. LAST INSTAR LARVA: BODY: length 29mm, A4 transverse width 5.5mm; preserved specimen pale; setae simple, to 0.3mm long on A4 dorsum; spiracles brown. HEAD: Figure 33B, brown, darker brown at vertex, scattered pits on upper face dark brown; transverse width 3.4mm; sculpturing rough to pitted; setae simple, to 0.2mm long at apex, a few ventral setae to 0.5mm; stemmata subequal (Figure 42X). THORAX: legs tan; shield narrow, a brown line between the annuli. ABDOMEN: prolegs each with about 90 crochets, irregularly triordinal, arranged in a near circle; suranal plate rounded, with tiny brown spots (Figure 54E); wax glands forming ventral transverse bands on A7-8. PUPA: Figures 73B and 95A, length 24mm, A3 transverse width 6mm; preserved specimen pale; thoracic spiracle guard distinct; setae simple, to 0.7mm long on head; pilifers touching; head rounded; antennal tip lies cephalad of tip of middle leg; proboscis extending into A7; abdomen long; cremaster to 1.8mm long, bluntly pointed with numerous hooked setae in a cluster at the tip (Figures 108G and 121B); lenticles present on the prothorax, dorsal abdomen, and proleg scars.

Other Descriptions. Saunders 1869a (egg, young larva), Scudder 1881 (egg, larva), French 1886 (egg, larva), Scudder 1889a (egg, larva, pupa). In the past, this species and *P.*

zabulon were considered to be conspecific, thus some of these descriptions may actually refer to the latter.

Host Plants. POACEAE: *Panicum* species (Shapiro 1966), *Poa* species (Shapiro 1966).

Specimens Examined. LARVAE: WISCONSIN: WAUKESHA CO.: Lot 372, 1 larva (instar 5) (MCM). PUPAE: WISCONSIN: WAUKESHA CO.: Lot 372, 1 pupa (MCM).

197. *Poanes zabulon* (Boisduval and Leconte)

Diagnosis. LAST INSTAR LARVA: BODY: length 12-23mm, A4 transverse width 3.2-4.7mm; preserved specimens brown; setae simple, to 0.2mm long on A4 dorsum; spiracles tan. HEAD: Figure 33C, brown; transverse width 2.5-2.3mm; sculpturing rough to pitted; setae simple, to 0.2mm long at apex, a few ventral setae to 0.3mm; stemmata subequal (Figure 42Y). THORAX: legs tan; shield narrow, a brown line between the annuli. ABDOMEN: prolegs each with about 95 crochets, irregularly triordinal, arranged in a near circle; suranal plate rounded with some tiny brown spots.

Other Descriptions. Laurent 1908 (egg, larva).

Host Plants. POACEAE: *Eragrostis* species (Shapiro 1966), *Tridens* species (Shapiro 1966).

Specimens Examined. LARVAE: PENNSYLVANIA: MONTGOMERY CO.: Lot 1001, 6 larvae (instar 5) (FSCA).

198. *Poanes taxiles* (Edwards)

Diagnosis. LAST INSTAR LARVA: BODY: length 21-27mm, A4 transverse width 4.7-5.3mm; pinkish brown, heart line dark,

subdorsal and lateral lines faint, outlined by dark bands; setae simple, to 0.2mm long on A4 dorsum; spiracles tan.

HEAD: Figure 33D, light brown with darker brown pits on upper face; transverse width 3.1-3.3mm; sculpturing rough to pitted; setae simple, to 0.2mm long at apex, a few ventral setae to 0.5mm; stemmata subequal (Figure 43A). **THORAX:** legs pale; shield narrow, a brown line between the annuli.

ABDOMEN: prolegs each with about 95 crochets, irregularly triordinal, arranged in a near circle; suranal plate rounded with some tiny dark spots. **PUPA:** Figures 73C and 95B, length 18-21.5mm, A3 transverse width 4.1-4.9mm; cream-colored, abdomen with dark spots, head and thorax with dark markings; thoracic spiracle guard distinct; setae simple, to 0.5mm long on head; pilifers touching; head rounded; antennal tip lies cephalad of tip of middle leg; proboscis extending into A8; abdomen long; cremaster to 1.7mm long, bluntly pointed with numerous hooked setae in a cluster at the tip (Figures 108H and 121C); lenticles present on the prothorax, dorsal abdomen, and proleg scars.

Other Descriptions. Scott 1986 (larva, pupa).

Host Plants. POACEAE: *Agropyron repens* (Scott 1986), *Agropyron smithii* (Scott and Scott 1980), *Agropyron trachycaulum* (Scott 1986), *Agrostis gigantea* (Scott 1986), *Bromus anomalus* (Bailowitz and Brock 1991), *Dactylis glomerata* (Scott 1986), *Dactylis* species (Stanford 1981), *Elymus arizonicus* (Bailowitz and Brock 1991), *Elymus*

canadensis (Scott 1986), *Poa pratensis* (Scott 1986),
Puccinellia airoides (Scott and Scott 1980).

Specimens Examined. LARVAE: COLORADO: EL PASO CO.: Lot 374, 5 larvae (instar 5) (MCM); Lot 375, 5 larvae (instar 5) (MCM); Lot 376, 1 larva (instar 5) (MCM); Lot 377, 7 larvae (instars 1, 3, 5) (MCM); Lot 378, 5 larvae (instar 5) (MCM). PUPAE: COLORADO: EL PASO CO.: Lot 373, 10 pupae (MCM); Lot 374, 4 pupae (MCM); Lot 375, 2 pupae (MCM); Lot 378, 4 pupae (MCM).

199. *Poanes aaroni* (Skinner)

Diagnosis. LAST INSTAR LARVA: BODY: length 33mm, A4 transverse width 4.8mm; pinkish brown, heart line dark, subdorsal and lateral lines bounded by dark bands; setae simple, to 0.2mm long on A4 dorsum; spiracles tan. HEAD: Figure 33E, light brown, medial and epicranial lines black, convergent at midadfrontals, area around stemmata black, posterior of head black; transverse width 2.9mm; sculpturing rough; setae simple, to 0.3mm long at apex, a few ventral setae to 1mm; stemmata subequal (Figure 43B). THORAX: legs pale; shield narrow, a dark brown line between the annuli. ABDOMEN: prolegs each with about 95 crochets, irregularly triordinal, arranged in a near circle; suranal plate rounded with tiny dark spots. PUPA: Figures 73D and 95C, length 22mm, A3 transverse width 4.3mm; cream-colored, head and prothorax blackish, faint brown spots and markings on thorax and abdomen; thoracic spiracle guard distinct; setae simple,

to 0.5mm long on head; pilifers touching; head rounded, cap somewhat bulbous; antennal tip lies far cephalad of tip of middle leg; proboscis extending into A6; abdomen moderately long; cremaster to 1.2mm long, sharply angled laterally, distal tip with a mesal indentation, hooked setae absent (Figures 108I and 121D); lenticles present on the prothorax, dorsum of abdomen, and proleg scars.

Other Descriptions. Laurent 1908 (egg, young larva).

Host Plants. POACEAE: *Panicum hemitomon* (MCM collection, associated with, in lab), *Spartina alternifolia* (Clark and Clark 1951, associated with).

Specimens Examined. LARVAE: FLORIDA: LAKE CO.: Lot 995, 5 larvae (instars 3, 4, 5) (MCM). PUPAE: FLORIDA: LAKE CO.: Lot 995, 1 pupa (MCM).

200. *Poanes yehl* (Skinner)

Diagnosis. EGG: Figure 4H, height 1-1.2mm, width 0.6-0.8mm, polygonal sculpturing, brownish white. LAST INSTAR LARVA: BODY: length 30-34mm, A4 transverse width 5.2-5.5mm; pinkish brown, heart line dark, subdorsal line bounded by faint dark bands; setae simple, to 0.2mm long on A4 dorsum; spiracles tan. HEAD: Figure 33F, black, orange-brown eye patches present; transverse width 3.3-3.5mm; sculpturing rough; setae simple, to 0.5mm long at apex, a few ventral setae to 1mm; stemmata subequal (Figure 43C). THORAX: legs pale; shield narrow, a dark band between the annuli. ABDOMEN: prolegs each with about 160 crochets,

irregularly triordinal, arranged in a mesal penellipse; suranal plate rounded, tan with tiny dark spots; no wax glands. PUPA: Figures 59C, 73E, and 95D, length 20.5mm, A3 transverse width 4.3mm; cream-colored, head and dorsum of thorax blackish, a few dark spots on abdomen; thoracic spiracle guard distinct; setae simple, to 0.6mm long on head; pilifers touching; head rounded, cap somewhat bulbous; antennal tip lies far cephalad of tip of middle leg; proboscis extending into A5; abdomen moderately long; cremaster to 1mm long, sharply angled laterally, distal tip with a mesal indentation, hooked setae absent (Figures 108J and 121E); lenticles present on the prothorax, dorsum of abdomen, and proleg scars.

Host Plants. POACEAE: *Arundinaria gigantea* (Scott 1986; MCM collection, in lab).

Specimens Examined. EGGS: FLORIDA: ALACHUA CO.: Lot 1523, 2 eggs (MCM). LARVAE: FLORIDA: ALACHUA CO.: Lot 383, 3 larvae (instar 1) (MCM); Lot 1509, 3 larvae (instar 5) (MCM). PUPAE: FLORIDA: ALACHUA CO.: Lot 1509, 1 pupa (MCM).

201. *Poanes viator* (Edwards)

Diagnosis. EGG: height 1.1-1.2mm, width 0.7-0.8mm, polygonal sculpturing, brownish white. LAST INSTAR LARVA: BODY: length 20-43mm, A4 transverse width 3.7-5.5mm; pinkish brown, heart line dark, subdorsal line bounded by dark bands; setae simple, to 0.3mm long on A4 dorsum;

spiracles tan. HEAD: Figure 33G, light brown, medial line black, scattered small dark spots on face, area around the stemmata black; transverse width 3.1-3.9mm; sculpturing rough; setae simple, to 0.3mm long at apex, a few ventral setae to 0.6mm; stemmata subequal (Figure 43D). THORAX: legs pale; shield narrow, a dark brown line between the annuli. ABDOMEN: prolegs each with about 60 crochets, irregularly triordinal, arranged in a mesal penellipse; suranal plate rounded, tan with small dark spots. PUPA: Figures 73F and 96A, length 22-32mm, A3 transverse width 4.2-5.6mm; cream-colored, head and dorsum of thorax blackish, abdomen with dark spots; thoracic spiracle guard distinct; setae simple, to 0.6mm long on head; pilifers touching; head rounded, cap bulbous, lobed along the margin; antennal tip lies far cephalad of tip of middle leg; proboscis extending slightly beyond the wings in A4; abdomen moderately long; cremaster to 1.8mm long, sharply angled laterally, distal tip with a mesal indentation, hooked setae absent (Figures 109A and 121F); lenticles present on the prothorax, dorsum of abdomen, and proleg scars.

Other Descriptions. Laurent 1908 (egg, young larva), Pyle 1981 (egg, larva).

Host Plants. CYPERACEAE: *Carex lacustris* (Shapiro 1971), *Carex rostrata* (Layberry et al. 1982), *Cyperus esculentus* (MCM collection, in lab). POACEAE: *Cynodon dactylon* (MCM collection, in lab), *Panicum* species (Pyle 1981), *Phragmites*

australis (Shapiro 1966, suspected: Shapiro and Shapiro 1973), *Zizania aquatica* (Forbes 1960, associated with; Shapiro 1966), *Zizaniopsis miliacea* (Kendall 1966b).

Specimens Examined. EGGS: TEXAS: GUADALUPE CO.: Lot 966, 8 eggs (MCM). LARVAE: FLORIDA: Lot 1289, 1 larva (instar 4) (DHH). ALACHUA CO.: Lot 379, 2 larvae (instars 2, 3); Lot 380, 2 larvae (instar 5) (MCM); Lot 707, 5 larvae (instar 5) (MCM); Lot 382, 9 larvae (instars 1, 3, 4) (MCM); Lot 1070, 1 larva (instar 5) (DHH); Lot 1071, 1 larva (instar 1) (DHH); Lot 1072, 1 larva (instar 5) (DHH). NORTH DAKOTA: RICHLAND CO.: Lot 544, 3 larvae (instar 1). SOUTH CAROLINA: BEAUFORT CO.: Lot 381, 1 larva (instar 5) (MCM). TEXAS: GUADALUPE CO.: Lot 966, 1 larva (instar 5) (ROK). PUPAE: FLORIDA: ALACHUA CO.: Lot 380, 1 pupa (MCM). TEXAS: GUADALUPE CO.: Lot 966, 3 pupae (ROK).

202. *Paratrytone melane* (Edwards)

Diagnosis. EGG: height 0.7-0.8mm, width 1.1-1.2mm, polygonal sculpturing. LAST INSTAR LARVA: BODY: length 12-29.5mm, A4 transverse width 3.9-5.3mm; preserved specimens pale; setae simple, to 0.1mm long on A4 dorsum, spiracles tan. HEAD: Figure 33H, brown; transverse width 3-3.8mm; sculpturing rough; setae simple, to 0.2mm long at apex, a few ventral setae to 0.5mm; stemmata subequal (Figure 43E). THORAX: legs pale; shield narrow, a brown line between the annuli. ABDOMEN: prolegs each with about 110 crochets, irregularly triordinal, arranged in a circle;

suranal plate rounded, tan with some small dark spots (Figure 54F). PUPA: Figures 73G and 96B, length 21mm, A3 transverse width 4.3mm; preserved specimens pale, brown markings on the head and thorax, abdomen with brown spots; thoracic spiracle guard distinct; setae simple, to 0.5mm long on head; pilifers touching; head rounded; antennal tip lies cephalad of tip of middle leg; proboscis extending into A6; abdomen long; cremaster to 1.8mm long, bluntly pointed with numerous hooked setae in a cluster at the tip (Figures 109B and 121G); lenticles on the prothorax, dorsal abdomen, and proleg scars.

Other Descriptions. Comstock and Dammers 1931 (egg, larva, pupa), Emmel and Emmel 1973 (egg, larva, pupa).

Host Plants. CYPERACEAE: *Carex spissa* (Brown 1984). POACEAE: *Bromus carinatus* (Scott 1986), *Bromus inermis* (Tietz 1972), *Cynodon dactylon* (Wright 1905), *Deschampsia caespitosa* (Emmel and Emmel 1973), *Digitaria ischaemum* (Tietz 1972), *Digitaria sanguinalis* (Tietz 1972), *Lamarckia aurea* (Brown 1984), *Stenotaphrum secundatum* (Brown 1984).

Specimens Examined. EGGS: MEXICO: NUEVO LEON: Lot 960, 4 eggs (ROK). LARVAE: MEXICO: NUEVO LEON: Lot 960, 13 larvae (instars 1, 3, 5) (ROK). USA: CALIFORNIA: Lot 639, 1 larva (instar 5) (TCE). PUPAE: CALIFORNIA: LOS ANGELES CO.: Lot 639, 1 pupa (TCE).

203. *Choranthus radians* (Lucas)

Dethier (1939b) described the egg and larva of this Caribbean species, but I could not find specimens for study.

Host Plants. POACEAE: *Saccharum officinarum* (Dethier 1939b).

204. *Choranthus haitensis* (Skinner)

Diagnosis. LAST INSTAR LARVA: BODY: length 28.5mm, A4 transverse width 3.5mm; light green, heart line dark; setae simple, to 0.2mm long on A4 dorsum; spiracles tan. HEAD: Figure 34A, light brown, epicranial and lateral lines black, posterior of head black; transverse width 2.3mm; sculpturing rough; setae simple, to 0.2mm long at apex, a few ventral setae to 0.4mm; stemmata subequal (Figure 43F). THORAX: legs pale; shield broad, black. ABDOMEN: prolegs each with about 145 crochets, irregularly triordinal, arranged in a near circle; suranal plate rounded with a large black patch (Figure 55A); wax glands forming ventral spots posterior of the prolegs on A3-6. PUPA: Figures 73H and 96C, length 19-23mm, A3 transverse width 3.7-4.2mm; cream-colored; thoracic spiracle guard distinct; setae simple, to 0.5mm long on head; pilifers touching; head rounded; antennal tip lies cephalad of tip of middle leg; proboscis extending into A7; abdomen long; cremaster to 1.3mm long, rounded with a few short dorsolateral spines, numerous hooked setae in a row along distal margin (Figures 109C and 121H); lenticles present on the prothorax, dorsal abdomen, and proleg scars.

Other Descriptions. Wolcott 1921 (egg, larva, pupa).

Host Plants. POACEAE: *Panicum maximum* (Minno 1990),

Saccharum officinarum (Wolcott 1921).

Specimens Examined. LARVAE: DOMINICAN REPUBLIC: LA VEGA

PROV.: Lot 125, 7 larvae (instars 2, 4) (MCM). PUPAE:

DOMINICAN REPUBLIC: LA VEGA PROV.: Lot 125, 2 pupae (MCM).

205. *Mellana eulogius* (Plötz)

This nonresident species from tropical America has been reported as feeding on sugar cane (*Saccharum officinarum*) (Dyar 1914), but the immature stages are undescribed.

206. *Mellana mexicana* (Bell)

Nothing is known of the biology of this neotropical species.

207. *Euphyes arpa* (Boisduval and Leconte)

Diagnosis. LAST INSTAR LARVA: BODY: Figure 21D, length 22.5-42mm, A4 transverse width 4.3-6.5mm; green, reticulated with pale yellow, bases of setae black; setae simple, to 0.2mm long on A4 dorsum; spiracles dark brown. HEAD: Figure 34B, pale, white on upper face, medial line modified into an elongate spot, epicranial line brown, becoming black near the apex, lateral line and posterior of head brown; transverse width 3.5-4.2mm; sculpturing slightly rough; setae simple, to 0.1mm long at apex, a few ventral setae to 0.5mm; stemma 5 and 6 small (Figure 43G). THORAX: legs pale; anterior shield white, posterior black. ABDOMEN: prolegs each with about 140 crochets, irregularly

triordinal, arranged in a mesal penellipse; suranal plate rounded, unmarked (Figure 55B); wax glands forming ventral transverse patches on A7-8. PUPA: Figures 74A and 96D, length 23-28mm, A3 transverse width 5.6-5.8mm; light brown; thoracic spiracle guard distinct; setae simple, to 0.5mm long on head; pilifers touching; head rounded; antennal tip lies far cephalad of tip of middle leg; proboscis extending into A5; abdomen moderately long; cremaster to 1.3mm long, rounded with a pair of dorsolateral spines, hooked setae absent (Figures 109D and 121I); lenticles present on the prothorax, dorsal abdomen, and proleg scars.

Other Descriptions. Edwards and Chapman 1879 (larva, pupa), Minno and Emmel 1993 (egg, larva).

Host Plants. ARECACEAE: *Sabal etonia* (Minno 1992), *Sabal palmetto* (Hayward 1947) [erroneous], *Sabal* species (Forbes 1960) [erroneous], *Serenoa repens* (Edwards and Chapman 1879). CYPERACEAE: *Cladium jamaicense* (Tietz 1972) [erroneous], *Cyperus esculentus* (MCM collection, in lab).

Specimens Examined. LARVAE: FLORIDA: Lot 1034, 1 larva (instar 5) (DHH). LEVY CO.: Lot 210, 9 larvae (instars 1, 3, 4) (MCM); Lot 211, 1 larva (instar 4) (MCM); Lot 1033, 1 larva (instar 5) (DHH). HIGHLANDS CO.: Lot 212, 4 larvae (instars 3, 5) (MCM); Lot 214, 3 larvae (instar 5) (MCM), Lot 215, 1 larva (instar 5) (MCM). PUPAE: FLORIDA: HIGHLANDS CO.: Lot 213, 2 pupae (MCM).

208. *Euphyes pilatka* (Edwards)

Diagnosis. LAST INSTAR LARVA: BODY: length 36-46mm, A4 transverse width 4.2-5.5mm; green, reticulated with pale yellow, bases of setae black; setae simple, to 0.2mm long on A4 dorsum; spiracles dark brown. HEAD: Figure 34C, pale, white on upper face, medial line modified into an elongate spot, epicranial line brown, becoming black near the apex, lateral line and posterior of head brown; transverse width 3.1-4mm; sculpturing slightly rough; setae simple, to 0.1mm long at apex, a few ventral setae to 0.4mm; stemma 5 and 6 small (Figure 43H). THORAX: legs pale; anterior shield white, posterior black. ABDOMEN: prolegs each with about 120 crochets, irregularly triordinal, arranged in a near circle; suranal plate rounded, unmarked; wax glands forming ventral transverse patches on A7-8. PUPA: Figures 74B and 97A, length 28mm, A3 transverse width 5.3mm; brown; thoracic spiracle guard distinct; setae simple, to 0.3mm long on head; pilifers touching; head rounded; antennal tip lies far cephalad of tip of middle leg; proboscis extending into A4; abdomen long; cremaster to 1.3mm long, rounded with a pair of dorsolateral spines, hooked setae absent (Figures 109E and 121J); lenticles present on the prothorax, dorsal abdomen, and proleg scars.

Other Descriptions. Edwards and Chapman 1879 (larva), Minno and Emmel 1993 (egg, larva).

Host Plants. CYPERACEAE: *Cladium jamaicense* (Edwards and Chapman 1879; Minno and Emmel 1993).

Specimens Examined. LARVAE: FLORIDA: BROWARD CO.: Lot 221, 16 larvae (instar 1) (MCM); Lot 222, 1 larva (instar 5) (MCM). MARION CO.: Lot 220, 1 larva (instar 5) (MCM). MONROE CO.: Lot 225, 3 larvae (instar 5) (MCM); Lot 673, 1 larva (instar 5) (MCM). PUTNAM CO.: Lot 674, 1 larva (instar 5) (MCM). PUPAE: FLORIDA: MONROE CO.: Lot 223, 1 pupa (MCM).

209. *Euphyes dion* (Edwards)

I could not find specimens of the immature stages of this eastern species for study.

Other Descriptions. Laurent 1908 (egg, young larva), Scott 1986 (egg, larva, pupa).

Host Plants. CYPERACEAE: *Carex emoryi* (Shuey 1986), *Carex hyalinolepis* (Opler and Krizek 1984), *Carex lacustris* (Shapiro 1971), *Carex walteriana* (Clark and Clark 1951, associated with; Opler and Krizek 1984), *Scirpus* species (Shapiro 1966).

210. *Euphyes alabamae*

Diagnosis. LAST INSTAR LARVA: BODY: length 38-45mm, A4 transverse width 4.8-5.8mm; green, reticulated with pale white; setae simple, to 0.2mm long on A4 dorsum; spiracles black. HEAD: Figure 34D, pale, medial line modified into an elongate spot, epicranial and lateral lines brown, posterior of head brown; transverse width 3.5-4mm;

sculpturing slightly rough; setae simple, to 0.1mm long at apex, a few ventral setae to 0.6mm; stemma 5 and 6 small (Figure 43I). THORAX: legs pale; anterior shield white, posterior black. ABDOMEN: prolegs each with about 125 crochets, irregularly triordinal, arranged in a near circle; suranal plate rounded, unmarked; wax glands forming ventral transverse patches on A7-8. PUPA: Figures 74C and 97B, length 23.5mm, A3 transverse width 5.3mm; brown; thoracic spiracle guard distinct; setae simple, to 0.4mm long on head; pilifers touching; head rounded; antennal tip lies far cephalad of tip of middle leg; proboscis extending into A5; abdomen moderately long; cremaster to 1.5mm long, rounded with a pair of dorsolateral spines, hooked setae absent (Figures 109F and 121K); lenticles present on the prothorax, dorsal abdomen, and proleg scars.

Host Plants. CYPERACEAE: *Carex emoryi* (ROK collection), *Carex lacustris* (Harris 1972), *Cyperus esculentus* (MCM collection, in lab), *Scirpus cyperinus* (Harris 1972).

Specimens Examined. LARVAE: FLORIDA: LEVY CO.: Lot 218, 1 larva (instar 3) (MCM). SOUTH CAROLINA: BEAUFORT CO.: Lot 219, 2 larvae (instar 5) (MCM). TEXAS: TARRENT CO.: Lot 941, 1 larva (instar 5) (ROK). PUPAE: SOUTH CAROLINA: BEAUFORT CO.: Lot 219, 1 pupa (MCM).

211. *Euphyes dukesi* (Lindsey)

Diagnosis. LAST INSTAR LARVA: BODY: length 40-47mm, A4 transverse width 5.1-5.8mm; green, reticulated with pale

white, bases of setae black; setae simple, to 0.3mm long on A4 dorsum; spiracles black. HEAD: Figure 34E, pale, white on upper face, medial line modified into an elongate spot, epicranial and lateral lines brown, posterior of head brown; transverse width 3.5-4mm; sculpturing slightly rough; setae simple, to 0.2mm long at apex, a few ventral setae to 0.6mm; stemma 6 small (Figure 43J). THORAX: legs pale; anterior shield white, posterior black. ABDOMEN: prolegs each with about 110 crochets, irregularly triordinal, arranged in a mesal penellipse; suranal plate rounded, unmarked; wax glands forming ventral transverse patches on A7-8. PUPA: Figures 74D and 97C, length 24-25mm, A3 transverse width 5.3-5.6mm; brown; thoracic spiracle guard distinct; setae simple, to 0.4mm long on head; pilifers touching; head rounded; antennal tip lies far cephalad of tip of middle leg; proboscis extending into A5; abdomen moderately long; cremaster to 1.3mm long, rounded with a pair of dorsolateral spines, hooked setae absent (Figures 109G and 121L); lenticles present on the prothorax, dorsal abdomen, and proleg scars.

Host Plants. CYPERACEAE: *Carex hyalinolepis* (Irwin and Downey 1973, probably; Opler and Krizek 1984), *Carex lacustris* (Forbes 1960, perhaps; Opler and Krizek 1984), *Carex lupulina* (MCM collection, in lab), *Carex walteriana* (Scott 1986), *Rhynchosia inundata* (MCM collection).

Specimens Examined. LARVAE: FLORIDA: PASCO CO.: Lot 672, 4 larvae (instar 5) (MCM). PUPAE: FLORIDA: PASCO CO.: Lot 669, 1 pupa (MCM); Lot 670, 4 pupae (MCM); Lot 671, 3 pupae (MCM).

212. *Euphyes conspicuus* (Edwards)

The immature stages of this midwestern species are undescribed, and I could not locate specimens for study.

Host Plants. CYPERACEAE: *Carex stricta* (Clark and Clark 1951).

213. *Euphyes berryi* (Bell)

Diagnosis. PUPA: Figures 74E and 97D, length 23.5mm, A3 transverse width 4.3mm; brown; thoracic spiracle guard distinct; setae simple, to 0.4mm long on head; pilifers touching; head rounded; antennal tip lies far cephalad of tip of middle leg; proboscis extending into A5; abdomen long; cremaster to 1.5mm long, rounded with a pair of dorsolateral spines, hooked setae absent (Figures 109H and 121M); lenticles present on the prothorax, dorsal abdomen, and proleg scars.

Host Plants. CYPERACEAE: *Carex* species (Shuey 1986, probably), *Cyperus esculentus* (MCM collection, in lab).

Specimens Examined. EGGS: FLORIDA: VOLUSIA CO.: Lot 1036, 1 egg (DHH). LARVAE: FLORIDA: VOLUSIA CO.: Lot 1037, 2 larvae (instar 1) (DHH); Lot 1539, 9 larvae (instar 1) (MCM). PUPAE: FLORIDA: VOLUSIA CO.: Lot 217, 1 pupa (MCM).

214. *Euphyes macguirei* H. A. Freeman

Diagnosis. LARVAL EXUVIUM: stemmata subequal (Figure 43K). PUPAL EXUVIUM: cremaster to 1.1mm long, rounded with a pair of dorsolateral spines, hooked setae absent with numerous hooked setae at tip (Figures 109I and 122A).

Host Plants. CYPERACEAE: *Carex emoryi* (ROK collection).

215. *Euphyes bimacula* (Grote and Robinson)

Diagnosis. LAST INSTAR LARVA: BODY: length 18-25mm, A4 transverse width 3.9-4mm; preserved specimens brownish; setae simple, to 0.1mm long on A4 dorsum; spiracles black. HEAD: Figure 34F, pale, white on upper face, medial line modified into an elongate spot, epicranial and lateral lines brown, posterior of head brown; transverse width 2.9-3.2mm; sculpturing slightly rough; setae simple, to 0.1mm long at apex, a few ventral setae to 0.5mm; stemmata subequal (Figure 43L). THORAX: legs pale; anterior shield white, posterior black. ABDOMEN: crochets, irregularly triordinal, arranged in a mesal penellipse; suranal plate rounded, unmarked. PUPA: Figures 74F and 97E, length 17.5mm, A3 transverse width 3.8mm; brown; thoracic spiracle guard distinct; setae simple, to 0.3mm long on head; pilifers touching; head rounded; antennal tip lies far cephalad of tip of middle leg; proboscis extending into A6; abdomen moderately long; cremaster to 0.7mm long, rounded with a pair of dorsolateral spines, hooked setae absent

(Figures 109J and 122B); lenticles present on the prothorax and proleg scars.

Other Descriptions. Laurent 1908 (egg), Scott 1986 (egg, larva).

Host Plants. CYPERACEAE: *Carex trichocarpa* (Shapiro and Shapiro 1973). POACEAE: (Tietz 1952) [erroneous].

Specimens Examined. LARVAE: PENNSYLVANIA: TIOGA CO.: Lot 1007, 4 larvae (instars 4, 5) (FSCA). PUPAE: PENNSYLVANIA: TIOGA CO.: Lot 1007, 1 pupa (FSCA).

216. *Euphyes ruricola* (Boisduval)

Diagnosis. EGG: Figures 3G, 4I and 5E, height 1.1-1.3mm, width 0.7-0.8mm, polygonal sculpturing, green with a red ring. LAST INSTAR LARVA: BODY: length 19-34mm, A4 transverse width 3.5-5.2mm; green, reticulated with pale white, heart line dark, bases of setae black; setae simple, to 0.2mm long on A4 dorsum; spiracles black. HEAD: Figure 34G, pale, white on upper face, medial line modified into an elongate spot, epicranial and lateral lines brown, posterior of head black; transverse width 2.7-3.4mm; sculpturing slightly rough; setae simple, to < 0.1mm long at apex, a few ventral setae to 0.4mm; stemma 6 small (Figure 43M).

THORAX: legs pale; anterior shield white, posterior black. ABDOMEN: prolegs each with about 120 crochets, irregularly triordinal, arranged in a near circle; suranal plate rounded, unmarked or sometimes distal margin edged with black and bearing a black crescent (Figure 55C); wax glands

forming ventral transverse patches on A7-8. PUPA: Figures 75A and 97F, length 17.5-22mm, A3 transverse width 3.9-4.3mm; head and thorax blackish, abdomen cream-colored; thoracic spiracle guard distinct; setae simple, to 0.4mm long on head; pilifers touching; head rounded; antennal tip lies far cephalad of tip of middle leg; proboscis extending into A5; abdomen long; cremaster to 1.2mm long, rounded with a pair of dorsolateral spines, hooked setae absent (Figures 109K and 122C); lenticles present on the prothorax, dorsal abdomen, and proleg scars.

Other Descriptions. Moffat 1894 (larva, pupa), Heitzman 1964a (egg, larva, pupa), Brown and McGuire 1983 (egg, larva, pupa), Emmel et al. 1992 (egg, larva).

Host Plants. CYPERACEAE: *Carex geophila* (Scott 1986), *Carex heliophila* (Scott and Scott 1980), *Carex lacustris* (Scott 1986), *Carex lupulina* (MCM collection), *Carex spissa* (Brown and McGuire 1983), *Carex stricta* (Shuey 1986), *Cyperus esculentus* (Heitzman 1964a, in lab; MCM collection, in lab), *Cyperus* species (Emmel and Emmel 1973). POACEAE: (Moffat 1894, in lab), *Tridens flavus* (Shapiro 1966) [questionable].

Specimens Examined. EGGS: FLORIDA: DUVAL CO.: Lot 1519, 10 eggs (MCM). LARVAE: CALIFORNIA: SAN DIEGO CO.: Lot 1011, 1 larva (instar 5) (SDNHM); Lot 1012, 1 larva (instar 5) (SDNHM); Lot 1013, 1 larva (instar 5) (SDNHM); Lot 1014, 1 larva (instar 5) (SDNHM); Lot 1015, 1 larva (instar 3)

(SDNHM); Lot 1016, 1 larva (instar 2) (SDNHM). COLORADO: EL PASO CO.: Lot 237, 6 larvae (instars 4, 5); Lot 239, 1 larva (instar 4) (MCM). FLORIDA: ALACHUA CO.: Lot 236, 2 larvae (instar 5) (MCM). DUVAL CO.: Lot 1519, 7 larvae (instar 1) (MCM). PUPAE: COLORADO: EL PASO CO.: Lot 237, 1 pupa (MCM); Lot 236, 3 pupae (MCM).

217. *Asbolis capucinus* (Lucas)

Diagnosis. LAST INSTAR LARVA: BODY: Figure 21C, length 25-57.5mm, A4 transverse width 4.8-8.2mm; yellowish green, heart line dark; some setae with blunt tips, to 0.3mm long on A4 dorsum; spiracles black. HEAD: Figure 34H, pale orange; transverse width 3.2-4.4mm; sculpturing slightly rough; setae simple, to 0.1mm long at apex, a few ventral setae to 0.4mm; stemmata subequal (Figure 43N). THORAX: legs pale; shield narrow, a black line between the annuli. ABDOMEN: prolegs each with about 235 crochets, irregularly triordinal, arranged in a near circle; suranal plate broad, rounded, edged with black (Figure 55D); wax glands forming small ventral spots posterior of the prolegs on A3-6 (Figure 15D). PUPA: Figures 75B and 98A, length 28-35.5mm, A3 transverse width 5-7mm; cream-colored to pale green, head and thorax blackish; thoracic spiracle guard distinct; setae simple, to 0.6mm long on head; pilifers separated; head rounded; antennal tip lies far cephalad of tip of middle leg; proboscis extending into A7; abdomen long; cremaster to

2.8mm long, broadly rounded with numerous hooked setae in a row along distal margin (Figures 109L and 122D); lenticles present on the prothorax, dorsal abdomen, and proleg scars.

Other Descriptions. Minno and Emmel 1993 (larva, pupa).

Host Plants. ARECACEAE: *Acoelorrhaphes wrightii* (Kimball 1965), *Chrysalidocarpus lutescens* (Minno and Emmel 1993), *Coccothrinax argentata* (Minno and Emmel 1993), *Cocos nucifera* (Bruner et al. 1945), *Dictyosperma album* (DHH collection), *Dictyosperma rubrum* (Bruner et al. 1945), *Phoenix dactylifera* (Opler and Krizek 1984), *Phoenix* species (Kimball 1965), *Roystonea regia* (Bruner et al. 1945), *Sabal etonia* (Minno 1992), *Sabal palmetto* (MacNeill 1975), *Sabal* species (Bruner et al. 1945), *Serenoa repens* (Minno and Emmel 1993), *Thrinax radiata* (Minno and Emmel 1993), *Veitchia merrillii* (Minno and Emmel 1993).

Specimens Examined. LARVAE: FLORIDA: BROWARD CO.: Lot 86, 1 larva (instar 5) (MCM); Lot 87, 1 larva (instar 5) (MCM). COLLIER CO.: Lot 1026, 1 larva (instar 5) (DHH). DADE CO.: Lot 92, 1 larva (instar 5) (MCM); Lot 660, 1 larva (instar 5) (MCM); Lot 789, 1 larva (instar 5) (USNM); Lot 791, 1 larva (instar 5) (USNM); Lot 1024, 1 larva (instar 5) (DHH); Lot 1025, 4 larvae (instars 3, 5) (DHH). HIGHLANDS CO.: Lot 84, 1 larva (instar 5) (MCM). MONROE CO.: Lot 85, 1 larva (instar 5) (MCM); Lot 90, 2 larvae (instar 5) (MCM); Lot 91, 2 larvae (instar 5) (MCM); Lot 790, 2 larvae (instar 5) (USNM); Lot 1022, 3 larvae (instar

5) (DHH); Lot 1028, 2 larvae (instar 5) (DHH). PALM BEACH CO.: Lot 877, 2 larvae (instar 5) (USNM); Lot 1019, 1 larva (instar 4) (DHH); Lot 1020, 3 larvae (instars 4, 5) (DHH); Lot 1021, 1 larva (instar 4) (DHH); Lot 1023, 2 larvae (instar 5) (DHH). PUPAE: FLORIDA: BROWARD CO.: Lot 86, 1 pupa (MCM). DADE CO.: Lot 661, 1 pupa (MCM); Lot 1018, 1 pupa (DHH). MONROE CO.: Lot 85, 1 pupa (MCM); Lot 89, 4 pupae (MCM); Lot 90, 1 pupa (MCM); Lot 790, 1 pupa (USNM); Lot 1022, 1 pupa (DHH); Lot 1028, 1 pupa (DHH). PALM BEACH CO.: Lot 877, 1 pupa (USNM); Lot 1019, 1 pupa (DHH); Lot 1027, 3 pupae (DHH).

218. *Atrytonopsis hianna* (Scudder)

Diagnosis. LAST INSTAR LARVA: BODY: Figure 20H, length 30mm, A4 transverse width 5.2mm; pinkish green or brown; setae simple, to 1.1mm long on A4 dorsum; spiracles tan. HEAD: Figure 35A, brown, paler around the mouth; transverse width 3.8mm; sculpturing rough, knobby at apex; setae simple, to 1.3mm long at apex, a few ventral setae to 1.3mm; stemmata subequal (Figure 430). THORAX: legs pale; shield narrow, a black line between the annuli. ABDOMEN: prolegs each with about 70 crochets, irregularly triordinal, arranged in a mesal penellipse; suranal plate rounded, tan (Figure 55E); wax glands forming small one or two ventral transverse patches on A7-8.

Other Descriptions. Harris 1972 (larva), Heitzman and Heitzman 1974 (egg, larva, pupa).

Host Plants. FABACEAE: *Glycine* species (Scudder 1869) [erroneous]. POACEAE: *Andropogon gerardii* (Heitzman and Heitzman 1970b), *Andropogon scoparius* (Shapiro and Shapiro 1973), *Andropogon* species (Shapiro 1966, associated with), *Calamovilfa brevipilis* (MCM collection).

Specimens Examined. LARVAE: MISSOURI: BENTON CO.: Lot 555, 4 larvae (instars 1, 4) (JRH). NEW JERSEY: BURLINGTON CO.: Lot 659, 1 larva (instar 5) (MCM). NORTH DAKOTA: RANSOM CO.: Lot 538, 3 larvae (instars 1, 3) (TLM).

219. *Atrytonopsis deva* (Edwards)

Nothing is known of the biology of this southwestern species.

220. *Atrytonopsis lunus* (Edwards)

Nothing is known of the biology of this southwestern species. Bailowitz and Brock (1991) listed the grass, *Muhlenbergia emersleyi*, as a probable larval host.

221. *Atrytonopsis vierecki* (Skinner)

Nothing is known of the biology of this western species.

222. *Atrytonopsis loammi* (Whitney)

Diagnosis. LAST INSTAR LARVA: BODY: length 34mm, A4 transverse width 5.5-5.7mm; pinkish green; setae simple, to 1.3mm long on A4 dorsum; spiracles tan. HEAD: light brown; transverse width 3.7-3.8mm; sculpturing rough, knobby at apex; setae simple, to 1.1mm long at apex, a few ventral setae to 1.8mm; stemmata subequal (Figure 43P). THORAX:

legs pale; shield narrow, a brown line between the annuli. ABDOMEN: prolegs each with about 80 crochets, irregularly triordinal, arranged in a mesal penellipse; suranal plate rounded, tan; wax glands forming small one or two ventral transverse patches on A7-8. PUPA: Figures 75C and 98B, length 19mm, A3 transverse width 3.8mm; cream-colored, abdomen reddish dorsally; thoracic spiracle guard distinct; setae simple, to 0.4mm long on head; pilifers touching; head rounded; antennal tip lies cephalad of tip of middle leg; proboscis extending into A7; abdomen long; cremaster to 2.3mm long, bluntly pointed with a few hooked setae in a cluster at the tip (Figures 110A and 122E); lenticles present on the prothorax, dorsal abdomen, and proleg scars.

Host Plants. POACEAE: *Andropogon* species (MCM collection, in lab).

Specimens Examined. LARVAE: FLORIDA: ST. JOHNS CO.: Lot 93, 2 larvae (instar 5) (MCM). PUPAE: FLORIDA: ST. JOHNS CO.: Lot 93, 1 pupa (MCM).

223. *Atrytonopsis pittacus* (Edwards)

Nothing is known of the biology of this southwestern species.

224. *Atrytonopsis python* (Edwards)

MacNeill (1975) described the egg and larva of this southwestern species, but I could not find specimens for study.

225. *Atrytonopsis cestus* (Edwards)

Nothing is known of the biology of this southwestern species.

226. *Atrytonopsis ovinia* (Hewitson)

The immature stages of this western species are undescribed and I could not find specimens for study.

Host Plants. POACEAE: *Bouteloua curtipendula* (Bailowitz and Brock 1991), *Leptochloa dubia* (Bailowitz and Brock 1991, suspected).

227. *Amblyscirtes simius* Edwards

The immature stages of this western species are undescribed, and I could not find specimens for study. MacNeill (1975) listed the grass, *Bouteloua gracilis*, as a larval host.

228. *Amblyscirtes exoteria* (Herrich-Schäffer)

Nothing is known of the immature stages of this southwestern species. Bailowitz and Brock (1991) listed the grass, *Muhlenbergia emersleyi*, as a probable larval host.

229. *Amblyscirtes cassus* Edwards

The immature stages of this southwestern species are undescribed, and I could not find specimens for study. The grass, *Panicum bulbosum*, is a larval host (Bailowitz and Brock 1991).

230. *Amblyscirtes aenus* Edwards

Scott (1986) described the egg, larva, and pupa of this southwestern species, but I could not find specimens for study.

Host Plants. POACEAE: *Bouteloua curtipendula* (Bailowitz and Brock 1991), *Bromus anomalus* (Bailowitz and Brock 1991), *Chasmanthium latifolium* (Scott 1986), *Digitaria sanguinalis*, *Eragrostis curvula*, *Setaria leucopila*, *Sorghum halepense* (Bailowitz and Brock 1991, probably), *Stenotaphrum secundatum* (ROK collection, in lab).

231. *Amblyscirtes linda* H. A. Freeman

Diagnosis. LAST INSTAR LARVA: BODY: length 19-21mm, A4 transverse width 3.3-3.8mm; preserved specimens pale; setae simple, to 0.1mm long on A4 dorsum; spiracles pale. HEAD: Figure 35B, pale, medial and epicranial lines broadly convergent along the adfrontals, black, front with a few dark lines, lateral line and posterior black; transverse width 2.3mm; sculpturing slightly rough; setae simple, to 0.1mm long at apex, a few ventral setae to 0.3mm; stemma 6 small (Figure 43Q); paraclypeal hooks present. THORAX: legs pale; shield narrow, a black line between the annuli. ABDOMEN: prolegs each with about 70 crochets, irregularly triordinal, arranged in a near circle; suranal plate rounded, unmarked (Figure 55F).

Other Descriptions. Heitzman and Heitzman 1970a (egg, larva, pupa).

Host Plants. POACEAE: *Chasmanthium latifolium* (Heitzman and Heitzman 1970a).

Specimens Examined. LARVAE: ARKANSAS: CARROLL CO.: Lot 571, 2 larvae (instar 5) (JRH).

232. *Amblyscirtes oslari* (Skinner)

The immature stages of this western species are undescribed, and I could not find specimens for study.

Host Plants. POACEAE: *Bouteloua gracilis* (Stanford 1981, probably), *Cynodon dactylon* (Bailowitz and Brock 1991, in lab).

233. *Amblyscirtes erna* H. A. Freeman

Nothing is known of the biology of this southwestern species.

234. *Amblyscirtes hegona* (Scudder)

Scudder (1889a) and Klots (1966) described the larva and pupa of this eastern species, but I could not find specimens for study.

Host Plants. POACEAE: *Andropogon* species (French 1886), *Chasmanthium latifolium* (Heitzman and Heitzman 1970a), *Poa pratensis* (Klots 1966), *Sorghastrum nutans* (MacNeill 1975), *Sorghastrum secundum* (Scudder 1889a), *Sorghum vulgare* var. *bicolor* (Tietz 1952).

235. *Amblyscirtes texanae* Bell

Nothing is known of the immature stages of this southwestern species. Bailowitz and Brock (1991) listed the grass, *Panicum bulbosum*, as a possible larval host.

236. *Amblyscirtes prenda* Evans

Nothing is known of the biology of this southwestern species.

237. *Amblyscirtes aesculapius* (Fabricius)

Diagnosis. LAST INSTAR LARVA: BODY: length 9.8-12mm, A4 transverse width 2-3.3mm; yellowish green, heart line dark; setae simple, to 0.2mm long on A4 dorsum; spiracles tan. HEAD: Figure 35C, pale, medial line black, front with a few dark lines, lateral line and posterior black; transverse width 1.9-2.3mm; sculpturing slightly rough; setae simple, to 0.2mm long at apex, a few ventral setae to 0.4mm; stemma 6 small (Figure 43R); paraclypeal hooks present. THORAX: legs pale; shield moderately broad, black. ABDOMEN: prolegs each with about 85 crochets, irregularly triordinal, arranged in a near circle; suranal plate rounded, unmarked; wax glands forming two ventrolateral patches on A7-8. PUPA: Figures 75D and 98C, length 16mm, A3 transverse width 3.3-3.7mm; cream-colored; thoracic spiracle guard distinct; setae simple, to 0.4mm long on head; pilifers touching; head rounded; antennal and middle leg tips nearly subequal; proboscis extending into A8; abdomen long; cremaster to 1.2mm long, bluntly pointed with numerous hooked setae in a cluster at the tip (Figures 110B and 122F); lenticles present on the prothorax and proleg scars.

Host Plants. POACEAE: *Arundinaria gigantea* (Opler and Krizek 1984).

Specimens Examined. LARVAE: FLORIDA: ALACHUA CO.: Lot 59, 1 larva (instar 5) (MCM); Lot 61, 1 larva (instar 5) (MCM). PUPAE: FLORIDA: ALACHUA CO.: Lot 60, 2 pupae (MCM); Lot 61, 1 pupa (MCM).

238. *Amblyscirtes carolina* (Skinner)

Nothing is known of the immature stages of this eastern species. Clark and Clark (1951) noted that the adults are associated with the grass, *Arundinaria gigantea*, the probably larval host.

239. *Amblyscirtes reversa* (F. M. Jones)

Nothing is known of the immature stages of this eastern species. Opler and Krizek (1984) listed the grass, *Arundinaria gigantea*, as the larval host.

240. *Amblyscirtes nereus* (Edwards)

Nothing is known of the biology of this southwestern species.

241. *Amblyscirtes nysa* Edwards

Heitzman (1964b) described the egg, larva, and pupa of this midwestern species, but I could not find specimens for study.

Host Plants. POACEAE: *Digitaria sanguinalis* (Heitzman 1964b), *Echinochloa crusgalli* (Heitzman 1964b), *Echinochloa muriacata* (Scott 1986), *Leptochloa dubia* (Bailowitz and Brock 1991, in lab), *Paspalum* species (Scott 1986), *Setaria glauca* (Heitzman 1964b), *Stenotaphrum secundatum* (Kendall 1960).

242. *Amblyscirtes eos* (Edwards)

Nothing is known of the immature stages of this southwestern species. Bailowitz and Brock (1991) listed the grass, *Panicum obtusum*, as a probable larval host.

243. *Amblyscirtes vialis* (Edwards)

Diagnosis. LAST INSTAR LARVA: BODY: length 11-23.5mm, A4 transverse width 3.5-4.5mm; green, heart line dark; setae simple, to 0.1mm long on A4 dorsum; spiracles pale. HEAD: Figure 35D, pale, medial and epicranial lines broadly convergent along the adfrontals, black, front with a few dark lines, lateral line and posterior black; transverse width 2.1-2.5mm; sculpturing slightly rough; setae simple, to 0.1mm long at apex, a few ventral setae to 0.3mm; stemma 6 small (Figure 43S); paracylpeal hooks present. THORAX: legs pale; shield narrow, a black line between the annuli. ABDOMEN: prolegs each with about 85 crochets, irregularly triordinal, arranged in a near circle; suranal plate rounded, unmarked; wax glands forming two ventrolateral patches on A7-8. PUPA: length 13-15mm, A3 transverse width 3.4-3.6mm; cream-colored; thoracic spiracle guard distinct; setae simple, to 0.4mm long on head; pilifers touching; head rounded; antennal tip lies cephalad of tip of middle leg; proboscis extending to the cremaster; abdomen long; cremaster to 1.2mm long, bluntly pointed with numerous hooked setae in a cluster at the tip (Figures 110C and 122G); lenticles indistinct or absent.

Other Descriptions. Fletcher 1888 (young larva), Scudder 1889a (egg, larva, pupa).

Host Plants. POACEAE: *Agrostis* species (Shapiro 1966), *Avena striata* (Scudder 1889a, in lab), *Chasmanthium latifolium* (Heitzman and Heitzman 1970a), *Cynodon dactylon* (Kendall 1965, in lab), *Erianthus alopecuroides* (MCM collection), *Poa pratensis* (Fletcher 1888, in lab).

Specimens Examined. LARVAE: NORTH CAROLINA: IREDELL CO.: Lot 62, 1 larva (instar 4) (MCM); Lot 63, 3 larvae (instar 5) (MCM). TEXAS: BROWN CO.: Lot 907, 20 larvae (instars 1, 3, 5) (ROK). PUPAE: TEXAS: BROWN CO.: Lot 907, 2 pupae (ROK).

244. *Amblyscirtes celia* Skinner

Diagnosis. EGG: height 0.8-1mm, width 0.6-0.7mm, polygonal sculpturing. LAST INSTAR LARVA: BODY: length 16-21mm, A4 transverse width 2.9-3.7mm; preserved specimens pale; setae simple, to 0.1mm long on A4 dorsum; spiracles tan. HEAD: Figure 35E, pale, medial line brown, front with a few brown lines, lateral line and posterior brown; transverse width 2-2.1mm; sculpturing slightly rough; setae simple, to 0.1mm long at apex, a few ventral setae to 0.3mm; stemmata subequal (Figure 43T); paracylpeal hooks present. THORAX: legs pale; shield broad, black. ABDOMEN: prolegs each with about 90 crochets, irregularly triordinal, arranged in a near circle; suranal plate rounded, unmarked. PUPA: Figures 75E and 98D, length 15.5-17mm, A3 transverse width

3.5-3.7mm; preserved specimens pale; thoracic spiracle guard distinct; setae simple, to 0.4mm long on head; pilifers narrowly separated; head rounded; antennal tip lies cephalad of tip of middle leg; proboscis extending into A8; abdomen moderately long; cremaster to 1mm long, bluntly with a few hooked setae in a cluster at the tip (Figures 110D and 122H); lenticles present on the prothorax and proleg scars.

Host Plants. POACEAE: *Paspalum* species (Scott 1986), *Stenotaphrum secundatum* (Kendall 1960).

Specimens Examined. EGGS: TEXAS: BEXAR CO.: Lot 906, 8 eggs (ROK). LARVAE: TEXAS: BEXAR CO.: Lot 906, 3 larvae (instar 5) (ROK). PUPAE: TEXAS: BEXAR CO.: Lot 906, 3 pupae (ROK).

245. *Amblyscirtes belli* H. A. Freeman

Heitzman (1965b) described the egg, larva, and pupa of this eastern species, but I could not find specimens for study.

Host Plants. POACEAE: *Chasmanthium latifolium* (Heitzman 1965b).

246. *Amblyscirtes alternata* (Grote and Robinson)

Nothing is known of the biology of this southeastern species.

247. *Amblyscirtes phylace* (Edwards)

Nothing is known of the biology of this southwestern species.

248. *Amblyscirtes fimbriata* (Plötz)

Coolidge (1911) described the egg and young larva of this species, but I could not find specimens for study.

Host Plants. POACEAE: *Bromus anomalus* (Bailowitz and Brock 1991), *Bromus inermis* (Bailowitz and Brock 1991, suspected), *Dactylis glomerata* (Bailowitz and Brock 1991, suspected), *Elymus arizonicus* (Bailowitz and Brock 1991).

249. *Lerodea eupala* (Edwards)

Diagnosis. EGG: height 1-1.2mm, 0.6-0.8mm, polygonal sculpturing, pale green to white. LAST INSTAR LARVA: BODY: Figure 21G, length 14-31mm, A4 transverse width 2.3-4.2mm; green with tiny white spots, heart, subdorsal, and lateral lines dark, narrow; setae simple, < 0.1mm long on A4 dorsum; spiracles tan. HEAD: Figure 35F, pale, medial line brown at vertex, broadly convergent with the brown epicranial lines, front brown, lateral line and posterior brown; transverse width 1.7-2.4mm; sculpturing slightly rough; setae simple, < 0.1mm long at apex, a few ventral setae to 0.2mm; stemma 6 small (Figure 43U). THORAX: legs pale; shield indistinct. ABDOMEN: prolegs each with about 85 crochets, irregularly triordinal, arranged in a near circle; suranal plate rounded, unmarked (Figure 56A); wax glands forming two ventrolateral patches on A7-8. PUPA: Figures 75F and 98E, length 16-20mm, A3 transverse width 2.1-3.8mm; pale green, heart line dark, faintly bounded by white; thoracic spiracle guard distinct; setae simple, < 0.1mm long

on head; pilifers narrowly separated; head with a long pointed process on cap; antennal tip lies cephalad of tip of middle leg; proboscis extending into A8; abdomen long; cremaster to 1.8mm long, blunt with numerous hooked setae in a cluster at the tip (Figures 110E and 122I); lenticles present on the prothorax and proleg scars.

Other Descriptions. Coolidge 1922 (egg, larva, pupa), Hayward 1926 (egg, young larva), Comstock 1929 (larva, pupa), Comstock 1930a (egg), Dethier 1939b (larva), Emmel and Emmel 1973 (egg, larva, pupa).

Host Plants. CYPERACEAE: *Cyperus* species (Hayward 1926, oviposition, but no larval feeding). FABACEAE: *Medicago sativa* (Field 1938) [erroneous]. POACEAE: *Bothriochloa barbinodis* var. *perforata* (MCM collection), *Brachiaria subquadripara* (MCM collection), *Cynodon dactylon* (Tilden 1965, associated with; Shapiro 1974b,c), *Digitaria* species (MCM collection, in lab), *Echinochloa crusgalli* (Shapiro 1974b,c), *Eustachys petraea* (MCM observation), *Oryza sativa* (Bruner et al. 1945), *Paspalum urvillei* (MCM collection), *Poa pratensis* (Tietz 1972), *Saccharum officinarum* (Dethier 1942d, in lab), *Setaria verticillata* (Shapiro 1974b), *Sorghum halepense* (Shapiro 1974b,c), *Sorghum sudanense* (MCM collection), *Sorghum vulgare* var. *bicolor* (Shapiro 1974b), *Stenotaphrum secundatum* (Kendall 1960, in lab; MCM observation), *Zea mays* (Scott 1986).

Specimens Examined. EGGS: FLORIDA: ALACHUA CO.: Lot 1513, 15 eggs (MCM). LARVAE: ARIZONA: YUMA CO.: Lot 820, 4 larvae (instar 5) (USNM). CALIFORNIA: RIVERSIDE CO.: Lot 573, 2 larvae (instar 5) (GRB). YOLO CO.: Lot 311, 1 larva (instar 5) (MCM); Lot 312, 7 larvae (instars 3, 4, 5) (MCM). FLORIDA: ALACHUA CO.: Lot 1513, 6 larvae (instar 1) (MCM). BROWARD CO.: Lot 313, 1 larva (instar 5) (MCM); Lot 314, 1 larva (instar 5) (MCM). DADE CO.: Lot 771, 1 larva (instar 5) (USNM). TEXAS: BEXAR CO.: Lot 309, 1 larva (instar 5) (MCM). HIDALGO CO.: Lot 772, 2 larvae (instars 3, 5) (USNM). JIM WELLS CO.: Lot 773, 1 larva (instar 3) (USNM). PUPAE: CALIFORNIA: YOLO CO.: Lot 312, 2 pupae (MCM). FLORIDA: BROWARD CO.: Lot 315, 1 pupa (MCM). TEXAS: BEXAR CO.: Lot 309, 2 pupae (MCM).

250. *Lerodea arabus* (Edwards)

The immature stages of this southwestern species are undescribed, and I could not find specimens for study.

Host Plants. POACEAE: *Cynodon dactylon* (Bailowitz and Brock 1991), *Leptochloa dubia* (Bailowitz and Brock 1991).

251. *Lerodea dysaules* Godman

The immature stages of this southwestern species are undescribed, and I could not find specimens for study.

Host Plants. POACEAE: *Cynodon dactylon* (Kendall 1976, in lab).

252. *Oligoria maculata* (Edwards)

Diagnosis. LAST INSTAR LARVA: BODY: length 24-30mm, A4 transverse width 4.3-4.8mm; pinkish green; setae simple, to 0.2mm long on A4 dorsum; spiracles tan to brown. HEAD: Figure 35G, brown; transverse width 3.5-3.6mm; sculpturing rough, pebbly at apex; setae simple, 0.2mm long at apex, a few ventral setae to 0.4mm; stemma 6 slightly small (Figure 44A). THORAX: legs pale; shield broad, dark brown. ABDOMEN: prolegs each with about 180 crochets, irregularly triordinal, arranged in a mesal penellipse; suranal plate rounded, unmarked (Figure 56B). PUPA: Figures 59D, 75G, and 98F, length 25mm, A3 transverse width 4.5mm; cream-colored; thoracic spiracle guard distinct; setae simple, to 0.6mm long on head; pilifers touching; head rounded; antennal tip lies far cephalad of tip of middle leg; proboscis extending into A8; abdomen moderately long; cremaster to 1.8mm long, blunt with numerous hooked setae in a row along the distal margin (Figures 110F and 122J); lenticles present on the prothorax, dorsal abdomen, and proleg scars.

Other Descriptions. Edwards and Chapman 1879 (larva, pupa), Minno and Emmel 1993 (egg, larva, pupa).

Host Plants. POACEAE: *Andropogon* species (MCM collection), *Digitaria* species (MCM collection, in lab).

Specimens Examined. LARVAE: FLORIDA: ALACHUA CO.: Lot 347, 1 larva (instar 2) (MCM). BROWARD CO.: Lot 346, 2

larvae (instar 5) (MCM). DUVAL CO.: Lot 95, 1 larva (instar 4) (MCM). PUPAE: FLORIDA: BROWARD CO.: Lot 346, 1 pupa (MCM).

253. *Calpodes ethlius* (Stoll)

Diagnosis. EGG: height 1.2mm, width 0.7-0.8mm, polygonal sculpturing, gray. LAST INSTAR LARVA: BODY: length 26-63mm, A4 transverse width 4.3-9.5mm; cuticle transparent, appearing dark green due to gut contents; some setae with blunt tips, < 0.1mm long on A4 dorsum; spiracles tan. HEAD: Figure 35H, tan with a black spot in center of face, stemmatal area black; transverse width 3.5-4.3mm; sculpturing rough; setae simple to blunt, 0.1mm long at apex, a few ventral setae to 0.5mm; stemmata subequal (Figure 44B). THORAX: T1-2 legs brown and tan, T3 legs pale; shield pale dorsally, brown laterally. ABDOMEN: prolegs each with about 195 crochets, multiordinal, ca. 2-3 ranks, arranged in a circle; suranal plate rounded, unmarked (Figure 57B); wax glands forming two ventrolateral patches on A7-8. PUPA: Figures 60C, 76A, and 99A, length 37-43.5mm, A3 transverse width 7-8.5mm; pale green, lenticles black, process on cap and free portion of proboscis tan; thoracic spiracle guard indistinct; setae simple, to 0.2mm long on head; pilifers separated; head with a slender, upturned process on cap; antennal tip lies far cephalad of tip of middle leg; proboscis extending beyond the cremaster; abdomen long; cremaster to 3.6mm long, bluntly pointed with

numerous hooked setae in a cluster at the tip (Figures 110G and 122K); lenticles present on the prothorax, dorsal abdomen, and proleg scars.

Other Descriptions. Dodge 1872, 1876 (larva, pupa), King 1882 (egg, larva, pupa), Scudder 1889a (egg, larva, pupa), Cockerell 1892, 1894 (egg, larva, pupa), Dyar 1898 (egg, larva, pupa), Chittenden 1905, 1912 (egg, larva, pupa), Mosher 1916 (pupa), Koehler 1927 (egg, larva, pupa), Weigel and Middleton 1926 (larva), Wolcott 1936 (larva), Dethier 1939b (larva), Moss 1949 (larva, pupa), Kirkpatrick 1957 (larva), Peterson 1962 (larva), Young 1982 (larva, pupa), Minno and Emmel 1993 (egg, larva, pupa).

Host Plants. APIACEAE: *Apium graveolens* (Kimball 1965) [erroneous]. ARACEAE: *Colocasia esculentum* (Chittenden 1905) [erroneous]. BRASSICACEAE: (Lenczewski 1980) [erroneous]. CANNACEAE: *Canna aurantiacea* (Hayward 1941), *Canna coccinea* (Wolcott 1923), *Canna edulis* (Wolcott 1923), *Canna flaccida* (Scudder 1889a,b), *Canna X generalis* (DHH collection), *Canna indica* (Dodge 1872). CUCURBITACEAE: *Lagenaria* species (da Costa Lima 1936) [erroneous]. EUPHORBIACEAE: *Phyllanthus* species (Kimball 1965) [erroneous]. MARANTACEAE: *Maranta arundinacea* (Ogilvie 1928), *Maranta* species (Bates 1935), *Thalia geniculata* (Opler and Krizek 1984). MUSACEAE: *Heliconia* species (USNM collection). ZINGIBERACEAE: (MCM collection).

Specimens Examined. EGGS: FLORIDA: ALACHUA CO.: Lot 1516, 4 eggs (MCM). LARVAE: NO DATA: Lot 1128, 1 larva (instar 5) (DHH). COLOMBIA: DEPT. VALLE DEL CAUCA: Lot 119, 2 larvae (instar 5) (MCM); Lot 120, 1 larva (instar 5) (MCM). COSTA RICA: GUANACASTE PROV.: Lot 1108, 2 larvae (instar 5) (DHH). DOMINICAN REPUBLIC: LA VEGA PROV.: Lot 118, 1 larva (instar 5) (MCM). JAMAICA: Lot 805, 5 larvae (instars 3, 4) (USNM). MEXICO: Lot 803, 1 larva (instar 2) (USNM). VIRGIN ISLANDS: ST. THOMAS: Lot 798, 2 larvae (instars 4, 5) (USNM). FLORIDA: ALACHUA CO.: Lot 663, 1 larva (instar 5) (MCM); Lot 1078, 2 larvae (instars 2, 3) (DHH); Lot 1091, 1 larva (instar 5) (DHH); Lot 1092, 2 larvae (instar 5) (DHH); Lot 1093, 2 larvae (instar 5) (DHH); Lot 1094, 1 larva (instar 5) (DHH); Lot 1095, 2 larvae (instar 5) (DHH); Lot 1096, 2 larvae (instars 3, 4) (DHH); Lot 1097, 4 larvae (instar 5) (DHH); Lot 1098, 1 larva (instar 5) (DHH); Lot 1099, 1 larva (instar 5) (DHH); Lot 1100, 1 larva (instar 5) (DHH); Lot 1102, 1 larva (instar 5) (DHH); Lot 1103, 1 larva (instar 5) (DHH); Lot 1104, 1 larva (instar 5) (DHH); Lot 1105, 3 larvae (instars 3, 5) (DHH); Lot 1106, 1 larva (instar 5) (DHH); Lot 1107, 2 larvae (instar 5) (DHH); Lot 1111, 3 larvae (instar 5) (DHH); Lot 1113, 2 larvae (instar 5) (DHH); Lot 1114, 3 larvae (instars 4, 5) (DHH); Lot 1116, 1 larva (instar 5) (DHH); Lot 1117, 1 larva (instar 5) (DHH); Lot 1118, 1 larva (instar 5) (DHH); Lot 1119, 1 larva (instar 3) (DHH); Lot

1120, 1 larva (instar 4) (DHH); Lot 1121, 1 larva (instar 5) (DHH); Lot 1122, 1 larva (instar 5) (DHH); Lot 1123, 1 larva (instar 3) (DHH); Lot 1124, 1 larva (instar 5) (DHH); Lot 1125, 1 larva (instar 5) (DHH); Lot 1126, 3 larvae (instar 5) (DHH); Lot 1129, 1 larva (instar 5) (DHH); Lot 1131, 1 larva (instar 5) (DHH); Lot 1132, 1 larva (instar 5) (DHH); Lot 1133, 1 larva (instar 5) (DHH); Lot 1135, 1 larva (instar 5) (DHH); Lot 1136, 1 larva (instar 3) (DHH); Lot 1138, 1 larva (instar 5) (DHH); Lot 1141, 1 larva (instar 5) (DHH); Lot 1142, 4 larvae (instars 3, 5) (DHH); Lot 1143, 1 larva (instar 5) (DHH); Lot 1145, 1 larva (instar 3) (DHH); Lot 1146, 1 larva (instar 5) (DHH); Lot 1147, 2 larvae (instar 5) (DHH); Lot 1148, 1 larva (instar 4) (DHH); Lot 1149, 1 larva (instar 3) (DHH); Lot 1150, 1 larva (instar 5) (DHH); Lot 1152, 3 larvae (instar 2) (DHH); Lot 1153, 1 larva (instar 5) (DHH); Lot 1154, 1 larva (instar 5) (DHH); Lot 1155, 3 larvae (instars 3, 5) (DHH); Lot 1156, 1 larva (instar 3) (DHH); Lot 1157, 1 larva (instar 5) (DHH); Lot 1158, 1 larva (instar 5) (DHH); Lot 1159, 2 larvae (instar 5) (DHH); Lot 1160, 1 larva (instar 5) (DHH); Lot 1161, 1 larva (instar 5) (DHH); Lot 1162, 3 larvae (instars 2, 3, 5) (DHH); Lot 1164, 2 larvae (instar 5) (DHH); Lot 1166, 1 larva (instar 2) (DHH); Lot 1168, 1 larva (instar 5) (DHH).
BROWARD CO.: Lot 11, 1 larva (instar 5) (MCM); Lot 121, 4 larvae (instar 3) (MCM); Lot 122, 1 larva (instar 5) (MCM).
COLLIER CO.: Lot 1127, 2 larvae (instar 5) (DHH). DUVAL

CO.: Lot 1110, 2 larvae (instars 3, 5) (DHH). HARDEE CO.: Lot 1165, 1 larva (instar 3) (DHH). HIGHLANDS CO.: Lot 1101, 3 larvae (instars 3, 4) (DHH); Lot 1163, 1 larva (instar 5) (DHH). INDIAN RIVER CO.: Lot 662, 1 larva (instar 5) (MCM); Lot 664, 4 larvae (instars 4, 5) (MCM). MARION CO.: Lot 1134, 1 larva (instar 5) (DHH). POLK CO.: Lot 1140, 1 larva (instar 5) (DHH). SARASOTA CO.: Lot 1137, 1 larva (instar 5) (DHH). TEXAS: CAMERON CO.: Lot 787, 2 larvae (instar 5) (USNM). PUPAE: DOMINICAN REPUBLIC: LA VEGA PROV.: Lot 118, 1 pupa (MCM). USA: ARIZONA: COCHISE CO.: Lot 540, 1 pupa (TLM). FLORIDA: Lot 1139, 1 pupa (DHH). ALACHUA CO.: Lot 1096, 3 pupae (DHH); Lot 1109, 4 pupae (DHH); Lot 1112, 4 pupae (DHH); Lot 1115, 3 pupae (DHH); Lot 1116, 1 pupa (DHH); Lot 1130, 1 pupa (DHH); Lot 1151, 2 pupa (DHH); Lot 1156, 1 pupa (DHH); Lot 1160, 1 pupa (DHH); Lot 1164, 1 pupa (DHH). BROWARD CO.: Lot 121, 1 pupa (MCM). INDIAN RIVER CO.: Lot 662, 1 pupa (MCM); Lot 664, 1 pupa (MCM).

254. *Panoquina panoquin* (Scudder)

Diagnosis. EGG: height 0.9mm, width 0.6-0.8mm, polygonal sculpturing, pale green. LAST INSTAR LARVA: BODY: Figure 21F, length 28.5-36.5mm, A4 transverse width 3.1-4.3mm; green, heart line dark, subdorsal line narrow, pale yellow; some setae with blunt tips, < 0.1mm long on A4 dorsum; spiracles tan. HEAD: Figure 36A, green; transverse width 2.4-2.8mm; sculpturing slightly rough; setae simple to

blunt, < 0.1mm long at apex, a few ventral setae to 0.2mm; stemma 1, 5, and 6 small (Figure 44C). THORAX: legs pale; shield indistinct. ABDOMEN: prolegs each with about 70 crochets, irregularly triordinal, arranged in a circle; suranal plate bluntly pointed, unmarked (Figure 56C). PUPA: Figures 76B and 99B, length 24-25mm, A3 transverse width 3.8mm; pale green, heart and subdorsal lines dark, outlined by pale yellow; thoracic spiracle guard indistinct; setae simple, < 0.1mm long on head; pilifers touching; head with a long pointed process on cap; antennal tip lies far cephalad of tip of middle leg; proboscis extending slightly beyond the wings in A4; abdomen long; cremaster to 2.2mm long, blunt with numerous hooked setae in a cluster at the tip (Figures 110H and 123A); lenticles indistinct or absent.

Other Descriptions. Skinner 1890 (egg, young larva), Laurent 1908 (egg, young larva), Pyle 1981 (egg, larva).

Host Plants. CYPERACEAE: *Scirpus* species (Clark and Clark 1951, associated with; Shapiro 1966) [erroneous]. POACEAE: *Distichlis spicata* (Shapiro and Shapiro 1973, associated with; MCM collection), *Spartina alternifolia* (MCM collection, DHH collection).

Specimens Examined. EGGS: FLORIDA: BREVARD CO.: Lot 1515, 16 eggs (MCM). LARVAE: FLORIDA: BREVARD CO.: Lot 705, 4 larvae (instar 5) (MCM). FLAGLER CO.: Lot 1511, 1 larva (instar 5) (MCM). LEVY CO.: Lot 353, 3 larvae (instar 5) (MCM). VOLUSIA CO.: Lot 706, 2 larvae (instars 2, 5)

(MCM); Lot 1510, 1 larva (instar 4) (MCM). PUPAE: FLORIDA: LEVY CO.: Lot 353, 1 pupa (MCM). VOLUSIA CO.: Lot 706, 1 pupa (MCM).

255. *Panoquina panoquinoides* (Skinner)

Diagnosis. LAST INSTAR LARVA: BODY: length 14.5-28mm, A4 transverse width 2-3.7mm; green, heart line dark, subdorsal line narrow, pale yellow; some setae with blunt tips, < 0.1mm long on A4 dorsum; spiracles tan. HEAD: green, sometimes with faint reddish stripes; transverse width 2.1-2.4mm; sculpturing slightly rough; setae simple, < 0.1mm long at apex, a few ventral setae to 0.2mm; stemma 1, 5, and 6 small (Figure 44D). THORAX: legs pale; shield indistinct. ABDOMEN: prolegs each with about 60 crochets, irregularly triordinal, arranged in a near circle; suranal plate rounded, unmarked (Figure 56D). PUPA: Figures 76C and 99C, length 19-20.5mm, A3 transverse width 3.1-3.4mm; pale green, heart and subdorsal lines dark, outlined by pale yellow; thoracic spiracle guard indistinct; setae simple, < 0.1mm long on head; pilifers touching; head with a long pointed process on cap; antennal tip lies far cephalad of tip of middle leg; proboscis extending slightly beyond the wings in A4; abdomen moderately long; cremaster to 2.3mm long, blunt with numerous hooked setae in a cluster at the tip (Figures 110I and 123B); lenticles present on dorsal abdomen and proleg scars.

Other Descriptions. Brown and Turner 1966 (egg, larva, pupa), Minno and Emmel 1993 (larva, pupa).

Host Plants. FABACEAE: *Mimosa pudica* (Brown and Heineman 1972) [erroneous]. POACEAE: *Cynodon dactylon* (Brown and Heineman 1972, in lab), *Distichlis spicata* (Pyle 1981, possibly; Minno and Emmel 1993), *Saccharum officinarum* (Riley 1975), *Sporobolus virginicus* (Clench and Bjorndal 1980, probably; Minno and Emmel 1993).

Specimens Examined. LARVAE: FLORIDA: DADE CO.: Lot 356, 2 larvae (instar 5) (MCM). MONROE CO.: Lot 354, 2 larvae (instar 5) (MCM); Lot 355, 2 larvae (instar 5) (MCM). PUPAE: FLORIDA: MONROE CO.: Lot 354, 2 pupae (MCM).

256. *Panoquina errans* (Skinner)

I could not locate specimens of this western species for study.

Other Descriptions. Dyar 1892 (egg, larva, pupa), Comstock 1931 (egg, larva, pupa), Brown and Turner 1966 (egg, larva, pupa), Emmel and Emmel 1973 (egg, larva, pupa).

Host Plants. POACEAE: *Cynodon dactylon* (Comstock 1931, in lab), *Distichlis spicata* (Dyar 1892).

257. *Panoquina ocola* (Edwards)

Diagnosis. LAST INSTAR LARVA: BODY: length 21-35mm, A4 transverse width 3.3-4.6mm; green, heart line dark, subdorsal and lateral lines narrow, pale yellow; some setae with blunt tips, < 0.1mm long on A4 dorsum; spiracles tan. HEAD: green; transverse width 2.4-3.1mm; sculpturing

slightly rough; setae simple, < 0.1mm long at apex, a few ventral setae to 0.3mm; stemma 1, 5, and 6 small (Figure 44E). THORAX: legs pale; shield indistinct. ABDOMEN: prolegs each with about 145 crochets, irregularly triordinal, arranged in a circle; suranal plate rounded, unmarked (Figure 56E). PUPA: Figures 76D and 99D, length 23-24.5mm, A3 transverse width 4-4.1mm; pale green, heart and subdorsal lines dark, outlined by pale yellow; thoracic spiracle guard indistinct; setae simple, < 0.1mm long on head; pilifers touching; head with a long pointed process on cap; antennal tip lies far cephalad of tip of middle leg; proboscis extending into A5; abdomen long; cremaster to 2.9mm long, blunt with numerous hooked setae in a cluster at the tip (Figures 110J and 123C); lenticles absent or indistinct.

Other Descriptions. Pyle 1981 (egg, larva, pupa), Minno and Emmel 1993 (larva, pupa).

Host Plants. POACEAE: *Cynodon dactylon* (MCM collection, in lab), *Hymenachne amplexicaulis* (Wolcott 1923), *Leersia hexandra* (MCM collection), *Oryza sativa* (Bell 1940), *Panicum repens* (Minno 1992), *Saccharum officinarum* (Wolcott 1923).

Specimens Examined. LARVAE: HONDURAS: DEPT. FRANCISCO MORAZAN: Lot 611, 2 larvae (instar 5) (SP). FLORIDA: ALACHUA CO.: Lot 13, 5 larvae (instar 5) (MCM); Lot 348, 3 larvae (instar 5) (MCM); Lot 1041, 1 larva (instar 3) (DHH); Lot 1063, 1 larva (instar 5) (DHH); Lot 1064, 1 larva

(instar 5) (DHH); Lot 1065, 1 larva (instar 5) (DHH). BROWARD CO.: Lot 350, 1 larva (instar 5) (MCM). Lot 352, 1 larva (instar 5) (MCM). HIGHLANDS CO.: Lot 351, 5 larvae (instars 3, 5) (MCM). PUPAE: HONDURAS: DEPT. FRANCISCO MORAZAN: Lot 611, 1 pupa (SP). FLORIDA: ALACHUA CO.: Lot 13, 1 pupa (MCM); Lot 348, 2 pupae (MCM). BROWARD CO.: Lot 349, 1 pupa (MCM).

258. *Panoquina hecebola* (Scudder)

Nothing is known of the biology of this neotropical species.

259. *Panoquina sylvicola* (Herrich-Schäffer)

Diagnosis. LAST INSTAR LARVA: BODY: length 20-29mm, A4 transverse width 2.8-4mm; green, heart line dark, subdorsal and lateral lines narrow, pale yellow; some setae with blunt tips, < 0.1mm long on A4 dorsum; spiracles tan. HEAD: green; transverse width 2.8-3.2mm; sculpturing slightly rough; setae simple, < 0.1mm long at apex, a few ventral setae to 0.4mm; stemmata subequal (Figure 44F). THORAX: legs pale; shield indistinct. ABDOMEN: prolegs each with about 120 crochets, irregularly triordinal, arranged in a circle; suranal plate rounded, unmarked (Figure 56F). PUPA: Figures 76E and 99E, length 27.5mm, A3 transverse width 4.5mm; pale green, heart and subdorsal lines dark, outlined by pale yellow; thoracic spiracle guard indistinct; setae simple, < 0.1mm long on head; pilifers separated; head with a long pointed process on cap; antennal tip lies far

cephalad of tip of middle leg; proboscis extending into A5; abdomen moderately long; cremaster to 2.2mm long, blunt with numerous hooked setae in a cluster at the tip (Figures 111A and 123D); lenticles present on dorsal abdomen and proleg scars.

Other Descriptions. Wolcott 1921 (larva, pupa), Jones and Wolcott 1922 (egg, larva, pupa), Dethier 1939b (egg, larva), Dethier 1942d (egg, larva, pupa).

Host Plants. POACEAE: *Axinopus compressus* (Brown and Heineman 1972), *Bambusa vulgaris* (Jones and Wolcott 1922), *Brachiaria mutica* (Wolcott 1923), *Eriochloa polystachya* (Jones and Wolcott 1922), *Oryza sativa* (Jones and Wolcott 1922), *Saccharum officinarum* (Van Dine 1913), *Sorghum halepense* (Jones and Wolcott 1922).

Specimens Examined. LARVAE: COLOMBIA: DEPT. VALLE DEL CAUCA: Lot 357, 1 larva (instar 5) (MCM); Lot 358, 5 larvae (instar 5) (MCM). PUPAE: COLOMBIA: DEPT. VALLE DEL CAUCA: Lot 357, 1 pupa (MCM).

260. *Panoquina evansi* (H. A. Freeman)

Nothing is known of the biology of this neotropical species.

261. *Nyctelius nyctelius* (Latreille)

Diagnosis. LAST INSTAR LARVA: BODY: length 26-39mm, A4 transverse width 4.3-6.6mm; bluish green, heart line dark; some setae with blunt tips, < 0.1mm long on A4 dorsum; spiracles pale. HEAD: Figure 36B, pale with broad, black

medial, epicranial, and lateral lines, occasionally black with two pale lines from near vertex to base of mandibles and pale eye patches, Caribbean populations: tan with light brown medial and epicranial stripes, becoming blackish toward middle of face and stemmatal area black; transverse width 3.3-3.5mm; sculpturing rough to pitted; setae simple, to 0.1mm long at apex, a few ventral setae to 0.6mm; stemmata subequal (Figure 44G). THORAX: T1-2 legs black, T3 legs dark brown; shield broad, black. ABDOMEN: prolegs each with about 85 crochets, irregularly triordinal, arranged in a circle; suranal plate rounded, unmarked (Figure 57A). PUPA: Figures 77A and 100A, length 27.5mm, A3 transverse width 6.5mm; green shaded with black; thoracic spiracle guard distinct; setae simple, to 0.9mm long on head; pilifers touching; head rounded; antennal tip lies far cephalad of tip of middle leg; proboscis extending into A6; abdomen long; cremaster to 1.8mm long, squarish with numerous hooked setae in a row along the distal margin (Figures 111B and 123E); lenticles present on the prothorax, dorsal abdomen and proleg scars.

Other Descriptions. Wolcott 1921 (larva, pupa), Jones and Wolcott 1922 (egg, larva, pupa), Dethier 1939b (larva, pupa), Dethier 1942d (egg, larva, pupa).

Host Plants. POACEAE: *Brachiaria mutica* (Bates 1935), *Oryza sativa* (Wolcott 1922), *Panicum maximum* (MCM

collection), *Saccharum officinarum* (Smyth 1919), *Sorghum* species (SP collection), *Zea mays* (Comstock 1944).

Specimens Examined. LARVAE: COSTA RICA: Lot 1087, 1 larva (instar 3) (DHH), probably this species. DOMINICAN REPUBLIC: LA VEGA PROV.: Lot 340, 2 larvae (instars 3, 5) (MCM). SANTIAGO PROV.: Lot 342, 1 larva (instar 5) (MCM). HONDURAS: Lot 607, 1 larva (instar 5) (SP); Lot 621, 2 larvae (instars 3, 4) (SP); Lot 622, 1 larva (instar 5) (SP); Lot 624, 1 larva (instar 5) (SP). DEPT. FRANCISCO MORAZAN: Lot 623, 1 larva (instar 5) (SP). MEXICO: Lot 817, 1 larva (instar 5) (USNM). NICARAGUA: Lot 816, 2 larvae (instar 5) (USNM); Lot 818, (instar 5) (USNM). PUERTO RICO: Lot 625, 1 larva (instar 5) (SP). PUPAE: DOMINICAN REPUBLIC: PUERTO PLATA PROV.: Lot 341, 1 pupa (MCM). NICARAGUA: Lot 818, 1 pupa (USNM).

262. *Thespieus macareus* (Herrich-Schäffer)

Nothing is known of the biology of this neotropical species.

Subfamily Megathyminae

Diagnosis. EGG: height 1.3-1.8mm, width 2.5-3mm, polygonal sculpturing, green, red, brown, or white. LAST INSTAR LARVA: BODY: length 19-86mm, A4 transverse width 5.75-11.67mm; cream-colored or bluish; setae; spiracles tan to dark, T1 and A8 spiracles largest. HEAD: uniformly colored; transverse width 3.3-5.8mm; sculpturing rough to pebbly; mandibles with or without teeth, pyrgine type

articulation; labial-submental complex relatively large; setae simple; stemmata usually subequal; postocciput wide or moderately wide. THORAX: prothorax larger than head; legs brown to black; shield broad; ventral prothoracic gland absent. ABDOMEN: A4 proleg with 65 to 130 crochets, irregularly triordinal, arranged in a circle, a near circle, or transverse bands, posterior prolegs always with a mesal penellipse; suranai plate rounded, unmarked; anal comb absent or poorly developed; wax glands present in the form of transverse patches on the ventral side of A7-8. PUPA: length 34-52mm, A3 transverse width 8-10.2mm; brown; thoracic spiracle guard distinct; pilifers separated; head rounded; antennal and middle leg tips subequal; proboscis short; abdomen long to very long; cremaster bluntly pointed without setae or broad and rounded with numerous setae, hooked setae absent.

263. *Agathymus neumoegeni* (Edwards)

Freeman (1951a) described the egg, larva, and pupa of this southwestern species, but I could not find specimens for study.

Host Plants. AGAVACEAE: *Agave chrysantha* (Freeman 1951a), *Agave deserti* (Tietz 1972), *Agave lechuguilla* (Scott 1986), *Agave palmeri* (Freeman 1951a), *Agave parryi* (Tinkham 1954).

264. *Agathymus carlsbadensis* (D. Stallings and Turner)

The immature stages of this species are undescribed, and I could not find specimens for study.

Host Plants. AGAVACEAE: *Agave parryi* (Freeman 1969).

265. *Agathymus florenceae* (D. Stallings and Turner)

The immature stages of this species are undescribed, and I could not find specimens for study.

Host Plants. AGAVACEAE: *Agave parryi* (Freeman 1969).

266. *Agathymus judithae* (D. Stallings and Turner)

Stallings and Turner (1957) illustrated the pupal terminalia of this species, but I could not find specimens for study.

Host Plants. AGAVACEAE: *Agave parryi* (Freeman 1960).

267. *Agathymus diablocensis* H. A. Freeman

Freeman (1962) described the larva and pupa of this species, but I could not find specimens for study.

Host Plants. AGAVACEAE: *Agave parryi* (Freeman 1962).

268. *Agathymus mcalpinei* (H. A. Freeman)

Freeman (1955) commented on the larva and pupa of this species, but I could not find specimens for study.

Host Plants. AGAVACEAE: *Agave scabra* (Freeman 1955).

269. *Agathymus chisosensis* (H. A. Freeman)

Freeman (1952b) briefly described the pupa of this species, but I could not find specimens for study.

Host Plants. AGAVACEAE: *Agave scabra* (Freeman 1952b).

270. *Agathymus aryxna* (Dyar)

Roever (1975) briefly described the egg of this species.

Host Plants. AGAVACEAE: *Agave chrysantha* (Roever 1975), *Agave deserti* (Bailowitz and Brock 1991), *Agave palmeri* (Stallings and Turner 1957).

271. *Agathymus baueri* (D. Stallings and Turner) Roever (1964) described the egg of this species.

Host Plants. AGAVACEAE: *Agave chrysantha* (Roever 1975), *Agave parryi* (Stallings and Turner 1954).

272. *Agathymus freemani* D. Stallings and Turner The immature stages of this species are undescribed.

Host Plants. AGAVACEAE: *Agave deserti* (Freeman 1969).

273. *Agathymus evansi* (H. A. Freeman) Comstock (1956a) described the larva and pupa of this species, but I could not find specimens for study.

Host Plants. AGAVACEAE: *Agave palmeri* (Freeman 1969), *Agave parryi* (Comstock 1956a).

274. *Agathymus mariae* (Barnes and Benjamin) Bonniwell (1931), Freeman (1951a), Stallings and Turner (1957), Freeman (1964a,b), and Roever (1975) have described immature stages of this species, but I could not find specimens for study.

Host Plants. AGAVACEAE: *Agave lechuguilla* (Tinkham 1944).

275. *Agathymus chinatiensis* H. A. Freeman Freeman (1964b) briefly described the larva and pupa of this species.

Host Plants. AGAVACEAE: *Agave lechuguilla* (Freeman 1964b).

276. *Agathymus lajitaensis* H. A. Freeman

Freeman (1964b) briefly described the larva and pupa of this species.

Host Plants. AGAVACEAE: *Agave lechuguilla* (Freeman 1964b).

277. *Agathymus rindgei* H. A. Freeman

Freeman (1964b) described the larva and pupa of this species.

Host Plants. AGAVACEAE: *Agave lechuguilla* (Freeman 1964b).

278. *Agathymus gilberti* H. A. Freeman

Host Plants. *Agave lechuguilla* (Freeman 1964b).

279. *Agathymus valverdiensis* Freeman

Diagnosis. LAST INSTAR LARVA: BODY: length 23-24mm, A4 transverse width 6.5-7.5mm; preserved specimens pale; setae simple, to 0.4mm long on A4 dorsum; spiracles tan. HEAD: Figure 36C, tan; transverse width 3.4-3.6mm; sculpturing slightly rough; setae simple, to 0.4mm long at apex, a few ventral setae to 0.6mm; stemmata subequal (Figure 44H).

THORAX: legs tan; shield broad, black dorsally, tan laterally. ABDOMEN: prolegs each with about 130 crochets, irregularly triordinal, arranged in a near circle; suranal plate rounded, unmarked (Figure 57C). PUPAL EXUVIA: Figure 100B, light brown; thoracic spiracle guard distinct; setae simple, < 0.1mm long on head; pilifers separated; head rounded; antennal tip extending nearly to tip of middle leg; proboscis extending midway between tip of middle leg and tip of wings; abdomen moderately long; cremaster to 1.7mm long,

bluntly pointed, setae absent (Figure 111C); lenticles absent.

Host Plants. *Agave lechuguilla* (Freeman 1966).

Specimens Examined. LARVAE: USA: TEXAS: VAL VERDE CO.: Lot 888, 9 larvae (instars 2, 3, 4, 5).

280. *Agathymus stephensi* (Skinner)

Diagnosis. LAST INSTAR LARVA: BODY: length 26mm, A4 transverse width 7.6mm; preserved specimen brownish; setae simple, to 0.8mm long on A4 dorsum; spiracles tan to brown. HEAD: tan; transverse width 3.3mm; sculpturing slightly rough; setae simple, to 0.6mm long at apex, a few ventral setae to 0.8mm; mandibles with a shallow tooth; stemma 5 slightly small (Figure 44I). THORAX: T1-2 legs brown, T3 legs tan; shield broad, black dorsally, tan laterally. ABDOMEN: prolegs each with about 105 crochets, irregularly triordinal, arranged in a near circle; suranal plate rounded, unmarked.

Other Descriptions. Comstock and Dammers 1934 (egg, larva, pupa), Comstock 1957 (larva, pupa), Emmel and Emmel 1973 (egg, larva, pupa).

Host Plants. AGAVACEAE: *Agave deserti* (Skinner 1912).

Specimens Examined. LARVAE: CALIFORNIA: SAN DIEGO CO.: Lot 1006, 1 larva (instar 5) (FSCA).

281. *Agathymus polingi* (Skinner)

Stallings and Turner (1957) and Roever (1964) described some aspects of the immature stages, but I could not find specimens for study.

Host Plants. AGAVACEAE: *Agave palmeri* (Freeman 1951a), *Agave schottii* (Barnes and McDunnough 1912), *Agave toumeyana* (Roever 1975).

282. *Agathymus alliae* (D. Stallings and Turner)

Stallings and Turner (1957), Emmel and Emmel (1973), and Roever (1975) described the immature stages, but I could not find specimens for study.

Host Plants. AGAVACEAE: *Agave utahensis* (Freeman 1969).

283. *Megathymus yuccae* (Boisduval and Leconte)

Diagnosis. EGG: height 2.9-3mm, width 1.3-1.8mm, polygonal sculpturing, pinkish brown. LAST INSTAR LARVA: BODY: Figure 21H, length 27-64mm, A4 transverse width 7-10.5mm; cream-colored; setae simple, to 0.6mm long on A4 dorsum; spiracles brown. HEAD: Figure 36D, reddish brown; transverse width 4.3-5.8mm; sculpturing rough to pebbly; mandibles without teeth; setae simple, to 0.2mm long at apex, a few ventral setae to 0.7mm; stemma 5 and 6 slightly small (Figure 44J). THORAX: legs brown; shield broad, black and brown dorsally. ABDOMEN: prolegs each with about 90 crochets, multiordinal, ca. 2-3 ranks, arranged in transverse bands; suranal plate rounded, tan to brown (Figure 57D); wax glands forming ventral transverse patches on A7-8. PUPAL EXUVIUM: Figure 100C, brown; thoracic

spiracle guard distinct; setae simple, < 0.1mm long on head; pilifers separated; head rounded; antennal tip extending nearly to tip of middle leg; proboscis slightly longer than tip of middle leg; abdomen very long; cremaster to 3.8mm long, broadly rounded with numerous simple setae, hooked setae absent (Figures 111D and 123F); lenticles absent.

Other Descriptions. Riley 1876a,b (egg, larva, pupa), Skinner 1917 (pupa), Harris 1972 (pupa), Matthews 1986 (egg, larva).

Host Plants. AGAVACEAE: *Agave* species (Remington 1959, feeding, but no survival), *Yucca aloifolia* (Riley 1876a,b), *Yucca filamentosa* (Riley 1876a,b), *Yucca flaccida* (Freeman 1952a), *Yucca glauca* (Tietz 1972), *Yucca gloriosa* (Riley 1876a,b), *Yucca smalliana* (Freeman 1952a).

Specimens Examined. EGGS: FLORIDA: MARION CO.: Lot 699, 1 egg (MCM). SUWANNEE CO.: Lot 700, 4 eggs (MCM). LARVAE: FLORIDA: HIGHLANDS CO.: Lot 4, 1 larva (instar 5) (MCM); Lot 318, 1 larva (instar 5) (MCM); Lot 320, 1 larva (instar 5) (MCM); Lot 321, 1 larva (instar 5) (MCM); Lot 328, 1 larva (instar 5) (MCM). LIBERTY CO.: Lot 324, 1 larva (instar 5) (MCM); Lot 325, 1 larva (instar 5) (MCM); Lot 326, 1 larva (instar 5) (MCM). MARTIN CO.: Lot 316, 1 larva (instar 5) (MCM); Lot 317, 1 larva (instar 5) (MCM). ORANGE CO.: Lot 1005, 7 larvae (instar 4) (FSCA). PUTNAM CO.: Lot 322, 1 larva (instar 5) (MCM); Lot 323, 1 larva (instar 3) (MCM); Lot 698, 1 larva (instar 5) (MCM).

LOUISIANA: SABINE PARISH: Lot 893, 7 larvae (instars 3, 5) (ROK). TEXAS: SMITH CO.: Lot 894, 1 larva (instar 5) (ROK).

284. *Megathymus coloradensis* Riley

Diagnosis. LAST INSTAR LARVA: BODY: length 34-86mm, A4 transverse width 7.5-11.7mm; cream-colored; setae simple, to 0.7mm long on A4 dorsum; spiracles brown. HEAD: dark reddish brown; transverse width 4.8-5.8mm; sculpturing rough to pebbly; mandibles without teeth; setae simple, to 0.2mm long at apex, a few ventral setae to 0.8mm; stemma 5 and 6 slightly small (Figure 44K). THORAX: legs dark brown; shield broad, dark brown and tan dorsally. ABDOMEN: prolegs each with about 90 crochets, multiordinal, ca. 2-3 ranks, arranged in transverse bands; suranal plate rounded, tan to brown; wax glands forming ventral transverse patches on A7-8. PUPA: Figures 77B and 100D, length 41.5-44mm, A3 transverse width 8.5mm; brown; thoracic spiracle guard indistinct; setae simple, < 0.1mm long on head; pilifers separated; head rounded; antennal tip lies cephalad of tip of middle leg; proboscis shorter than tip of middle leg; abdomen very long; cremaster to 3.3mm long, broadly rounded with numerous simple setae, hooked setae absent (Figures 111E and 123G); lenticles absent.

Other Descriptions. Comstock and Dammers 1934 (egg, larva, pupa), Tinkham 1954 (egg, larva, pupa), Emmel and Emmel 1973 (egg, larva, pupa), Toliver 1987 (larva).

Host Plants. AGAVACEAE: *Yucca angustifolia* (Skinner 1911), *Yucca arizonica* (Bailowitz and Brock 1991), *Yucca arkansana* (Freeman 1951b), *Yucca baccata* (Brown et al. 1957), *Yucca baileyi* (Brown et al. 1957), *Yucca brevifolia* (Comstock and Dammers 1934), *Yucca campestris* (Freeman 1963), *Yucca carnerosana* (Stallings and Turner 1957), *Yucca constricta* (Freeman 1965), *Yucca elata* (Tinkham 1954), *Yucca freemanii* (Freeman 1969), *Yucca glauca* (Freeman 1963), *Yucca harrimaniae* (Brown et al. 1957), *Yucca louisianensis* (Freeman 1963), *Yucca navajoa* (Scott 1986), *Yucca necopina* (Freeman 1965), *Yucca pallida* (Freeman 1963), *Yucca reverchonii* (Freeman 1963), *Yucca rupicola* (Freeman 1963), *Yucca schidigera* (Comstock and Dammers 1934), *Yucca schottii* (Stallings and Turner 1956), *Yucca tenuistyla* (Scott 1986), *Yucca thompsoniana* (Freeman 1963), *Yucca thornberryi* (Tinkham 1954), *Yucca torreyi* (Freeman 1963), *Yucca treculeana* (Stallings and Turner 1957), *Yucca verdiensis* (Wielgus et al. 1971).

Specimens Examined. LARVAE: ARIZONA: COCONINO CO.: Lot 793, 1 larva (instar 5) (USNM). MOHAVE CO.: Lot 792, 1 larva (instar 5) (USNM). YAVAPAI CO.: Lot 794, 1 larva (instar 5) (USNM). CALIFORNIA: LOS ANGELES CO.: Lot 641, 2 larvae (instar 5) (TCE); Lot 642, 1 larva (instar 5) (TCE). SAN BERNARDINO CO.: Lot 1496, 1 larva (instar 5) (GRB). TEXAS: BEXAR CO.: Lot 889, 1 larva (instar 5) (ROK); Lot 891, 3 larvae (instar 5) (ROK). BAILEY CO.: Lot

890, 1 larva (instar 5) (ROK). PUPAE: CALIFORNIA: LOS ANGELES CO.: Lot 641, 2 pupae (TCE).

285. *Megathymus cofaqui* (Strecker)

Diagnosis. EGG: Figures 3I and 5F, height 2.8-3mm, width 1.5-1.7mm, polygonal sculpturing, white. LAST INSTAR LARVA: BODY: length 19-22.5mm, A4 transverse width 5.8-7mm; cream-colored; setae simple, to 0.9mm long on A4 dorsum; spiracles brown. HEAD: dark reddish brown; transverse width 3.6-4.2mm; sculpturing rough to pebbly; mandibles without teeth; setae simple, to 0.7mm long at apex, a few ventral setae to 0.8mm; stemma 5 and 6 slightly small (Figure 44L). THORAX: legs tan; shield broad, tan dorsally. ABDOMEN: prolegs each with about 65 crochets, irregularly triordinal, arranged in transverse bands; suranal plate rounded, tan. PUPA: Figures 77C and 100E, length 34mm, A3 transverse width 8mm; brown; thoracic spiracle guard distinct; setae simple, 0.5mm long on head; pilifers separated; head rounded; antennal and middle leg tips nearly subequal; proboscis extending to tip of middle leg; abdomen long; cremaster to 2.7mm long, broadly rounded with numerous simple setae, hooked setae absent (Figures 111F and 123H); a few lenticles present on the dorsal abdomen.

Other Descriptions. Skinner 1917 (pupa), Matthews 1986 (egg, larva, pupa).

Host Plants. AGAVACEAE: *Yucca aloifolia* (Bonniwell 1916), *Yucca filamentosa* (Roever 1975), *Yucca gloriosa* (Roever 1975, perhaps), *Yucca smalliana* (Roever 1975).

Specimens Examined. EGGS: FLORIDA: PUTNAM CO.: Lot 327, 2 eggs (MCM); Lot 693, 1 egg (MCM); Lot 694, 1 egg (MCM); Lot 1512, 2 eggs (MCM). MARION CO.: Lot 695, 2 eggs (MCM). LARVAE: FLORIDA: PUTNAM CO.: Lot 329, 1 larva (instar 5) (MCM); Lot 694, 1 larva (instar 1) (MCM); Lot 696, 1 larva (instar 4) (MCM). PUPAE: FLORIDA: HILLSBOROUGH CO.: Lot 1004, 1 pupa (FSCA).

286. *Megathymus harrisi* H. A. Freeman
Harris (1954, 1972) described the egg, larva, and pupa
of this species.

Host Plants. AGAVACEAE: *Yucca filamentosa* (Harris 1954), *Yucca smalliana* (Remington 1959).

287. *Megathymus streckeri* (Skinner)
Leussler (1930) and Wielgus and Stallings (1974)
described the immature stages of this southwestern species,
but I could not find specimens for study.

Host Plants. AGAVACEAE: *Yucca angustissima* (Roever 1975), *Yucca baileyi* (Brown et al. 1957), *Yucca glauca* (Holland 1898), *Yucca navajoa* (Scott 1986).

288. *Megathymus texanus* Barnes and McDunnough

Wielgus and Stallings (1974) and McCabe and Post (1977) described the immature stages of this Great Plains species.

Host Plants. AGAVACEAE: *Yucca constricta* (Roever 1975), *Yucca glauca* (Freeman 1951b).

289. *Megathymus ursus* Poling

Diagnosis. LAST INSTAR LARVA: BODY: length 34-58mm, A4 transverse width 6.3-11.2mm; preserved specimens pale; setae simple, to 0.6mm long on A4 dorsum; spiracles tan. HEAD: dark reddish brown; transverse width 3.9-5.4mm; sculpturing rough; mandibles without teeth; setae simple, to 0.2mm long at apex, a few ventral setae to 0.8mm; stemmata subequal (Figure 44M). THORAX: legs brown; shield broad, black and brown dorsally. ABDOMEN: prolegs each with about 85 crochets, multiordinal, ca. 2-3 ranks, arranged in transverse bands; suranal plate rounded, dark brown. PUPA: Figures 77D and 100F, length 52mm, A3 transverse width 10.2mm; brown; thoracic spiracle guard indistinct; setae simple, to 0.3mm long on head; pilifers separated; head rounded; antennal and middle leg tips nearly subequal; proboscis shorter than tip of middle leg; abdomen long; cremaster to 4mm long, broadly rounded with numerous simple setae, hooked setae absent (Figures 111G and 123I); lenticles absent.

Other Descriptions. Wielgus et al. 1972 (larva, pupa), Roever 1975 (egg, larva).

Host Plants. AGAVACEAE: *Yucca arizonica* (Roever 1975), *Yucca baccata* (Stallings and Turner 1956; Wielgus et al. 1972; Roever 1975), *Yucca brevifolia* (Bailowitz and Brock 1991), *Yucca faxoniana* (Roever 1975), *Yucca schottii* (Stallings and Turner 1956), *Yucca thornberryi* (Wielgus et al. 1973), *Yucca torreyi* (Stallings and Turner 1956), *Yucca treculeana* (Roever 1975).

Specimens Examined. LARVAE: ARIZONA: PINAL CO.: Lot 795, 1 larva (instar 4) (USNM). TEXAS: BREWSTER CO.: Lot 892, 1 larva (instar 5) (ROK). PUPAE: TEXAS: BREWSTER CO.: Lot 892, 2 pupae (ROK).

290. *Stallingsia maculosa* (H. A. Freeman)
Freeman (1955) and Roever (1975) described the immature stages of this southwestern species, but I could not find specimens for study.

Host Plants. AGAVACEAE: *Polianthes maculosa* (= *Manfreda maculosa*) (Freeman 1951a).

Figure 19. Last instar larva of *Autochton cellus* (A), *Epargyreus clarus* (B), *Thorybes pylades* (C), *Urbanus proteus* (D), *Urbanus dorantes* (E), *Polygonus leo* (F), *Gesta gesta* (G), and *Erynnis horatius* (H).

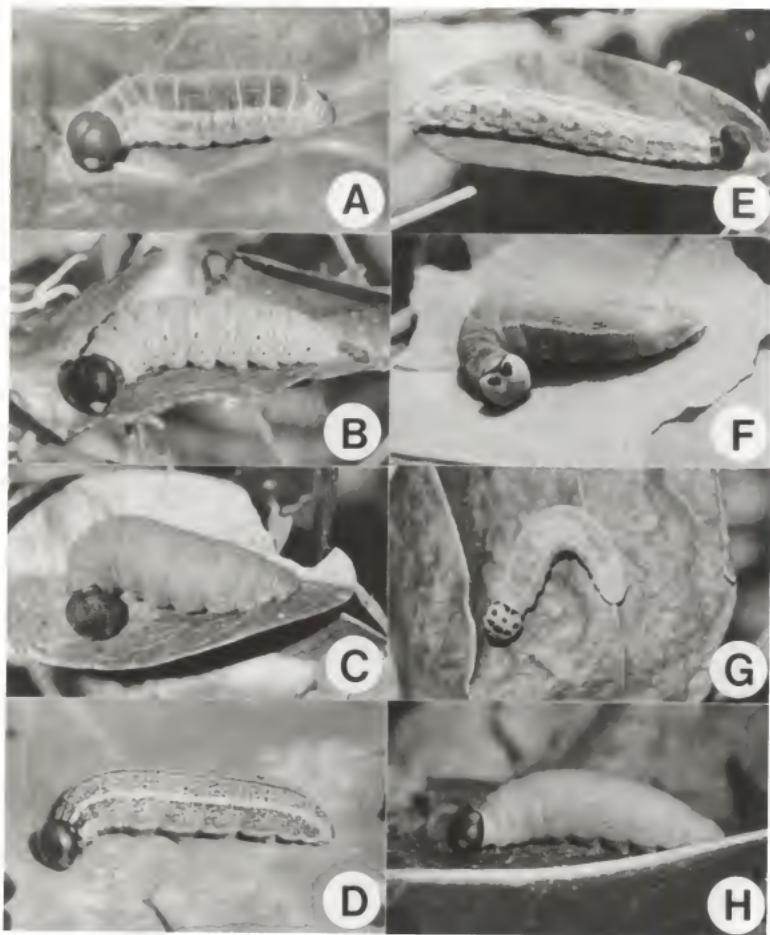


Figure 20. Last instar larva of *Achlyodes thraso* (A), *Pholisora catullus* (B), *Pyrgus oileus* (C), *Staphylus hayhurstii* (D), *Hesperia attalus* (E), *Pompeius verna* (F), *Wallengrenia egeremet* (G), and *Atrytonopsis hianna* (H).

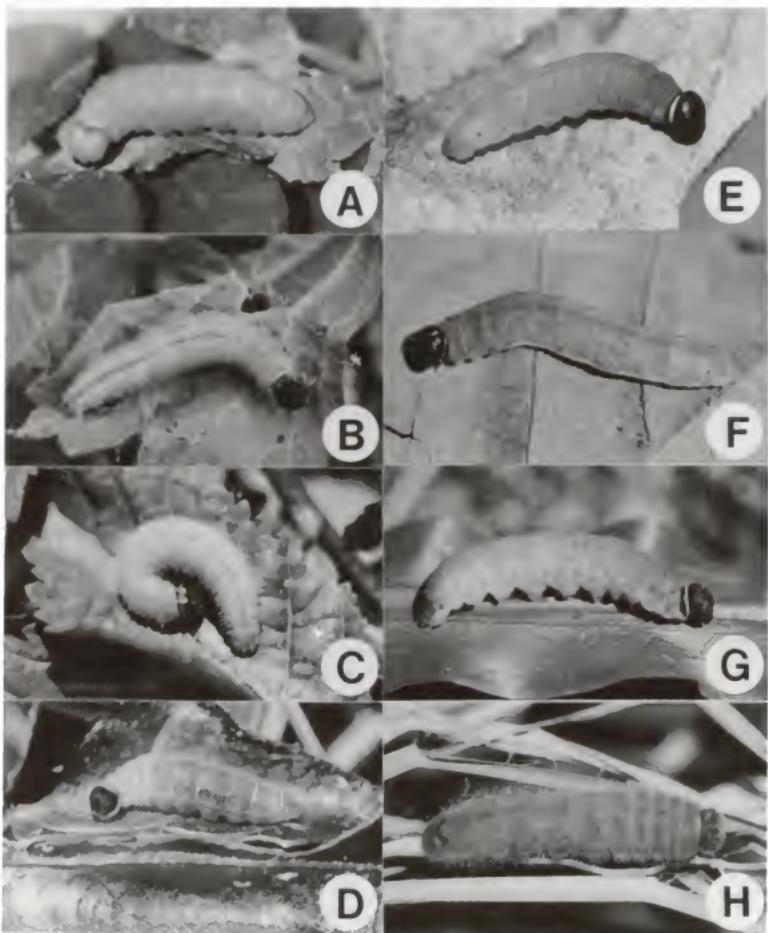
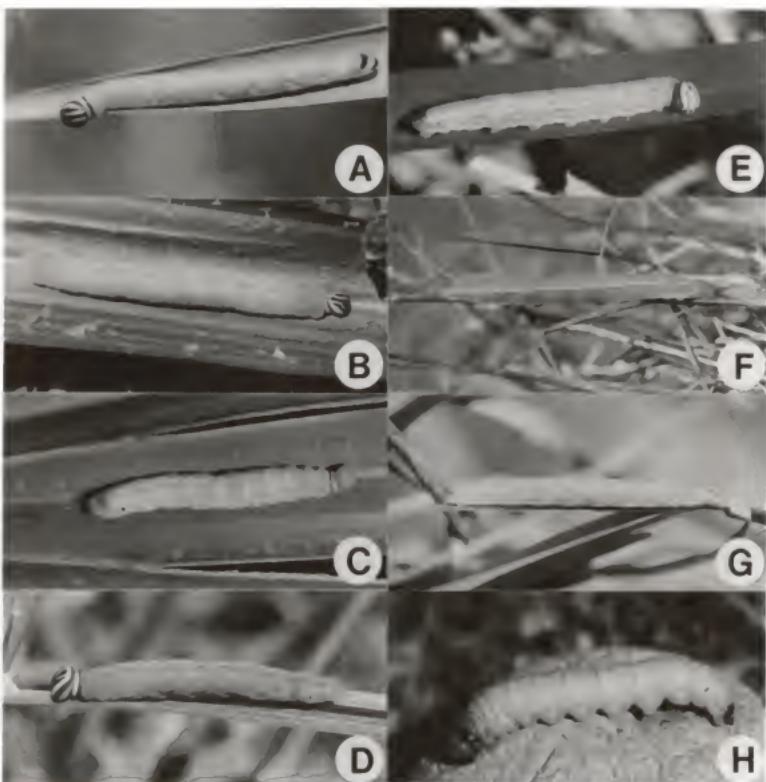


Figure 21. Last instar larva of *Atrytone delaware* (A), *Problema byssus* (B), *Asbolis capucinus* (C), *Euphyes arpa* (D), *Lerema accius* (E), *Panoquina panoquin* (F), *Lerodea eufala* (G), and *Megathymus yuccae* (H).



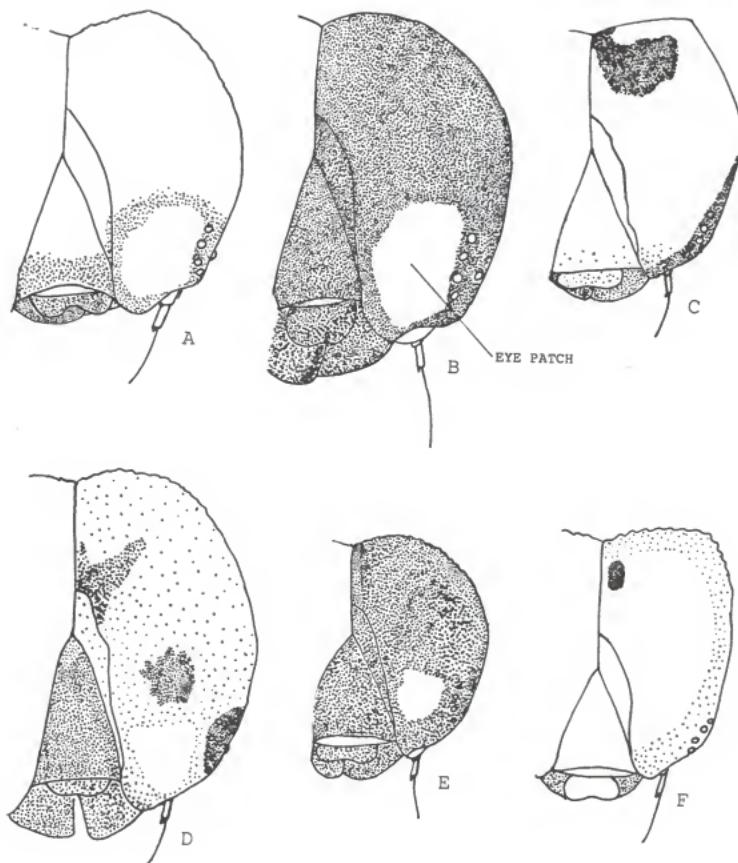


Figure 22. Frontal view of the larval head of *Phocides palemon* (A), *Epargyreus clarus* (B), *Polygonus leo* (C), *Chicoides catillus* (D), *Typhedanus undulatus* (E), and *Polythrix mexicana* (F). All drawings are enlarged 12 times.

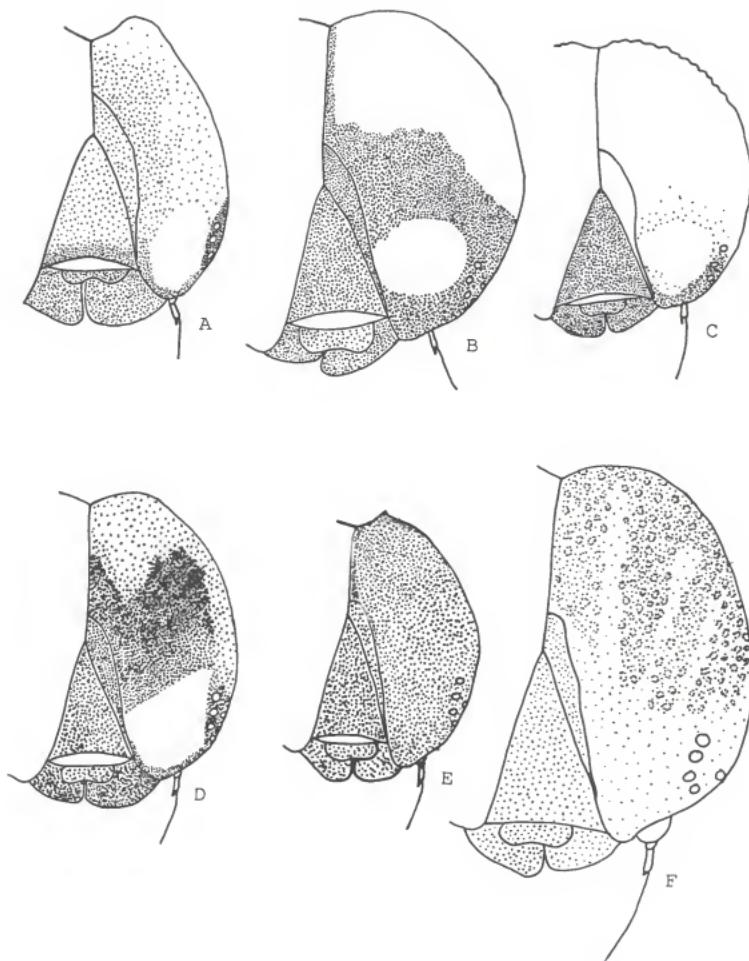


Figure 23. Frontal view of the larval head of *Polythrix procera* (A), *Codatractus alcaeus* (B), *C. arizonensis* (C), *Urbanus proteus* (D), *Urbanus dorantes* (E), and *Astraptes fulgerator* (F). All drawings are enlarged 12 times.

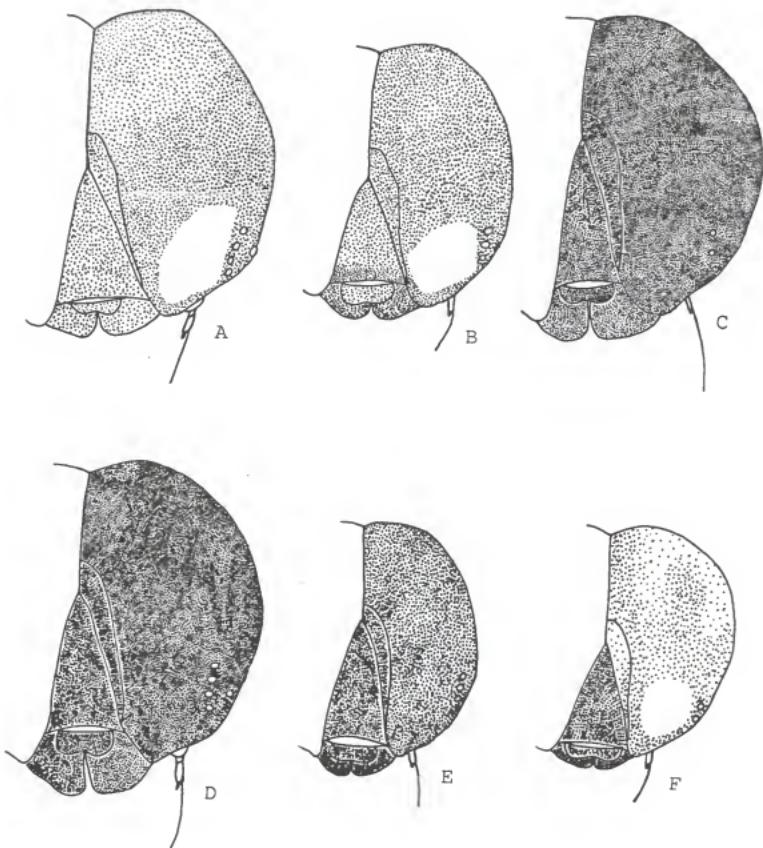


Figure 24. Frontal view of the larval head of *Astraptes gilberti* (A), *Autochton cellus* (B), *Achalarus lyciades* (C), *Thorybes bathyllus* (D), *Cabares potrillo* (E), and *Cogia hippalus* (F). All drawings are enlarged 12 times.

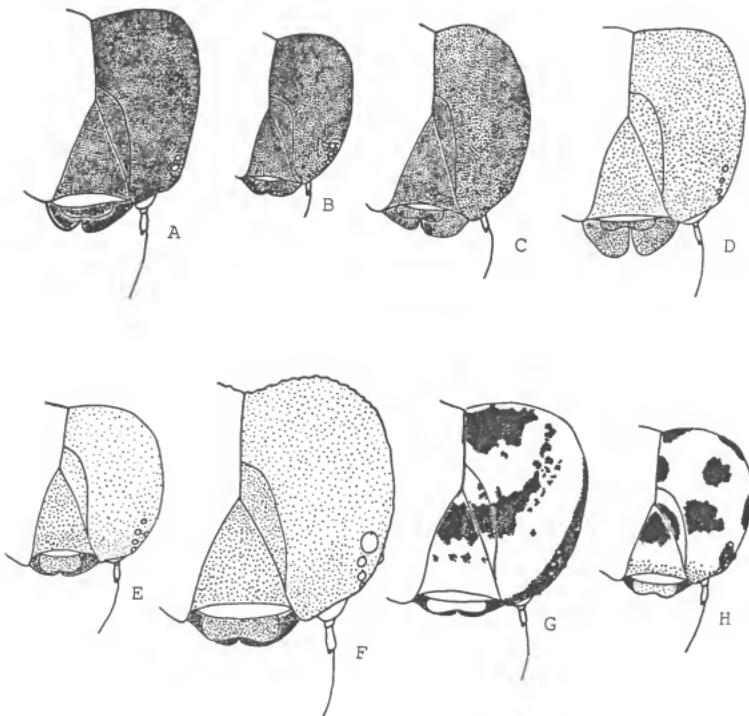


Figure 25. Frontal view of the larval head of *Nisoniades rubescens* (A), *Staphylus ceos* (B), *Carrhenes canescens* (C), *Xenophanes trixus* (D), *Systasea pulverulenta* (E), *Achlyodes thraso* (F), *Timochares ruptifasciatus* (G), and *Gesta gesta* (H). All drawings are enlarged 12 times.

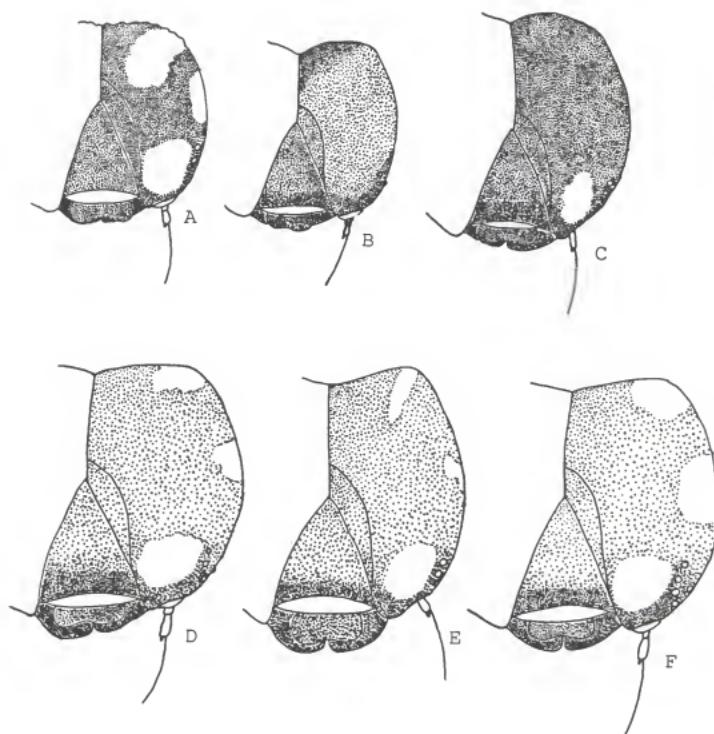


Figure 26. Frontal view of the larval head of *Ephyriades brunneus* (A), *Erynnis icelus* (B), *E. brizo* (C), *E. juvenalis* (D), *E. propertius* (E), and *E. horatius* (F). All drawings are enlarged 12 times.

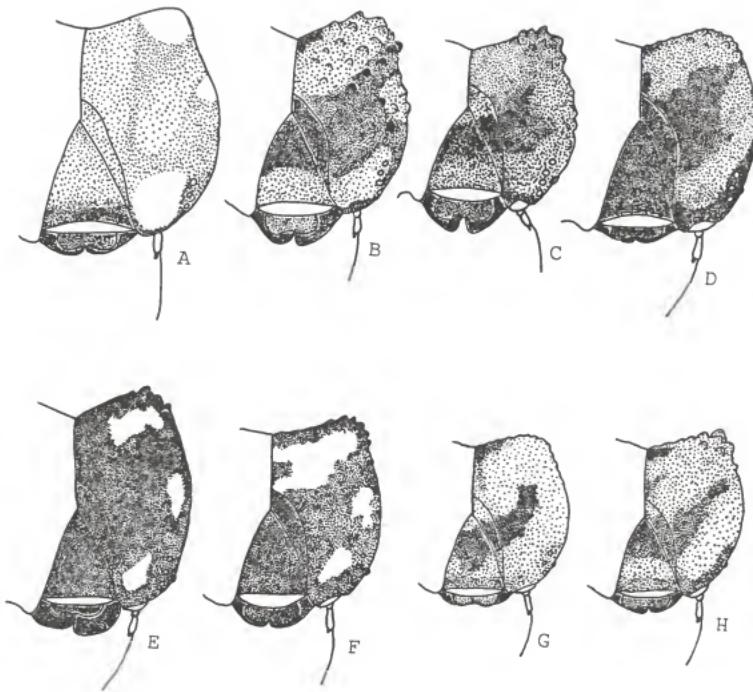


Figure 27. Frontal view of the larval head of *Erynnis tristis* (A), *E. martialis* (B), *E. pacuvius* (C), *E. zarucco* (D), *E. funeralis* (E), *E. baptisiae* (F), *E. afranius* (G), and *E. persius* (H). All drawings are enlarged 12 times.

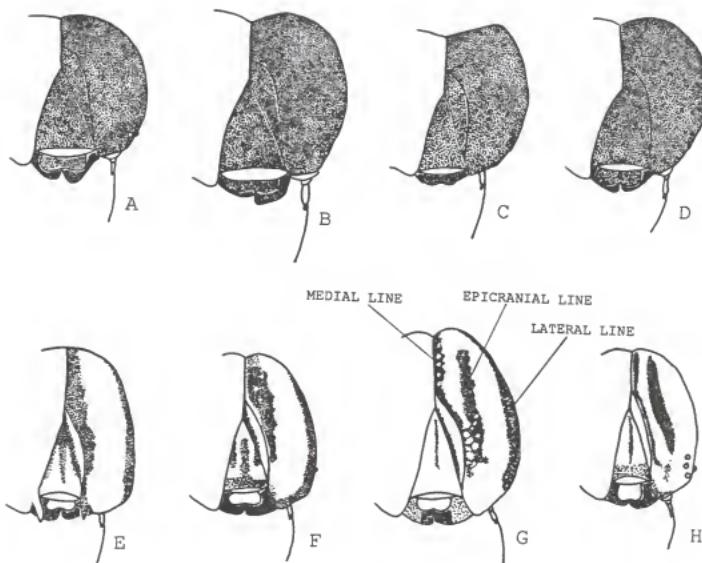


Figure 28. Frontal view of the larval head of *Pyrgus centaureae* (A), *Helioptetes ericetorum* (B), *Celotes nessus* (C), *Pholisora catullus* (D), *Piruna pirus* (E), *Synapte malitiosa* (F), *Vidius perigenes* (G), and *Nastra lherminier* (H). All drawings are enlarged 12 times.

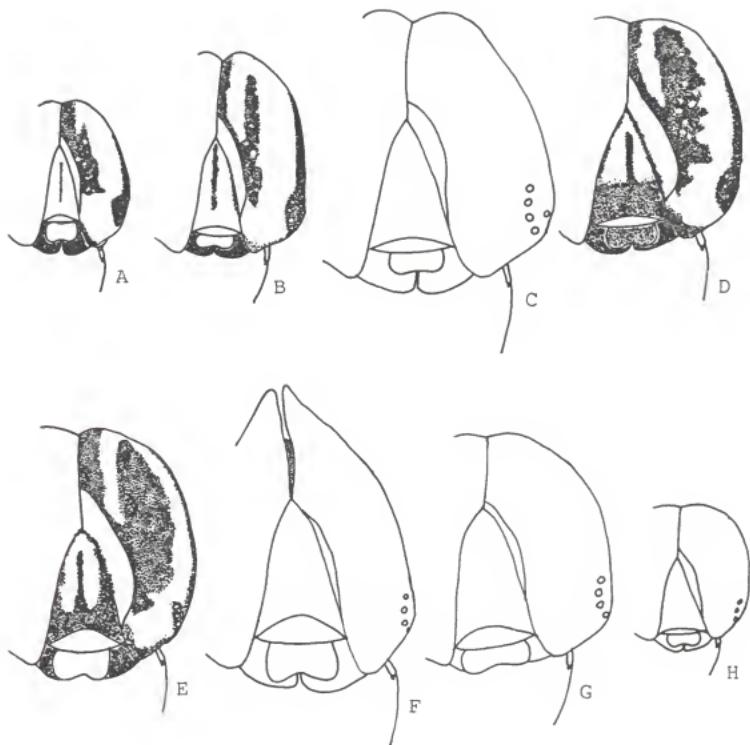


Figure 29. Frontal view of the larval head of *Cymaenes tripunctus* (A), *Lerema accius* (B), *Perichares philetetes* (C), *Ancyloxypha numitor* (D), *A. arene* (E), *Copaeodes aurantiacus* (F), *C. minimus* (G), and *Thymelicus lineola* (H). Drawings A-C and H are enlarged 12 times; D-G are enlarged 25 times.

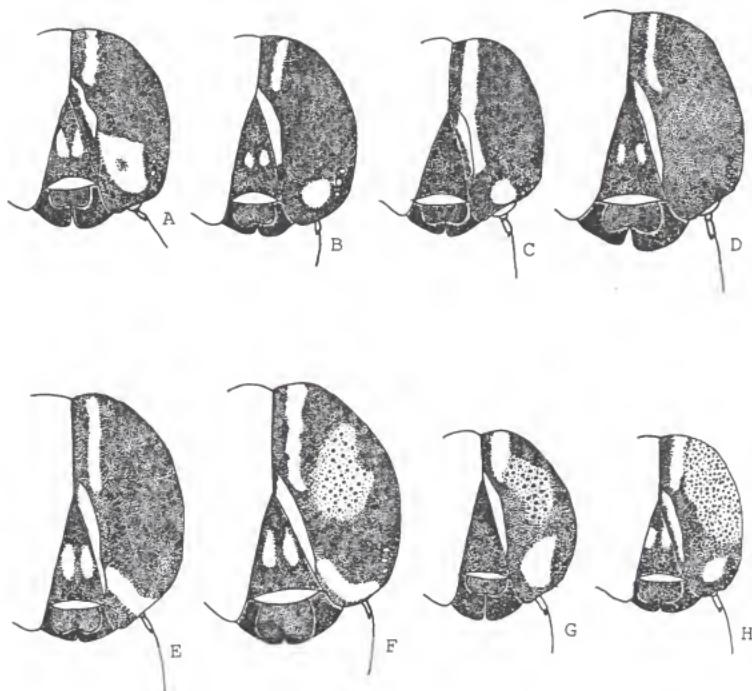


Figure 30. Frontal view of the larval head of *Hylephila phyleus* (A), *Yvretta carus* (B), *Pseudocopaeodes eunus* (C), *Hesperia uncas* (D), *H. leonardus* (E), *H. pahaska* (F), *Polites coras* (G), and *P. sabuleti* (H). All drawings are enlarged 12 times.

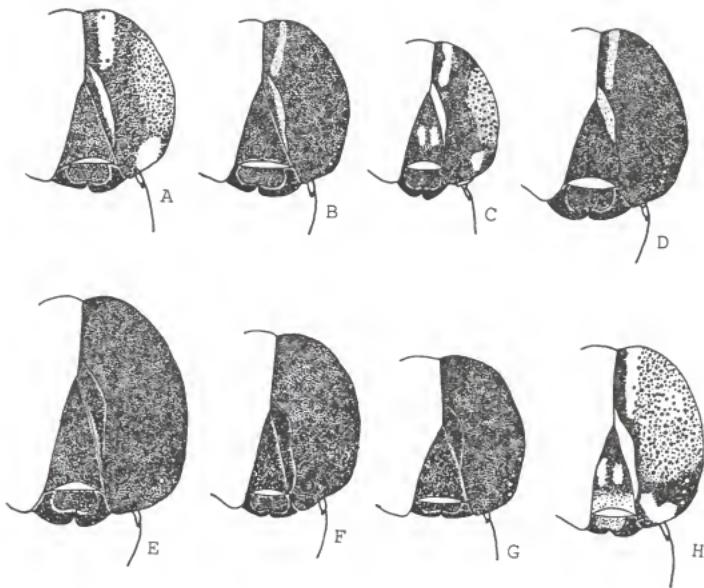


Figure 31. Frontal view of the larval head of *Polites mardon* (A), *P. draco* (B), *P. baracoa* (C), *P. themistocles* (D), *P. origenes* (E), *P. mystic* (F), *P. sonora* (G), and *P. vibex* (H). All drawings are enlarged 12 times.

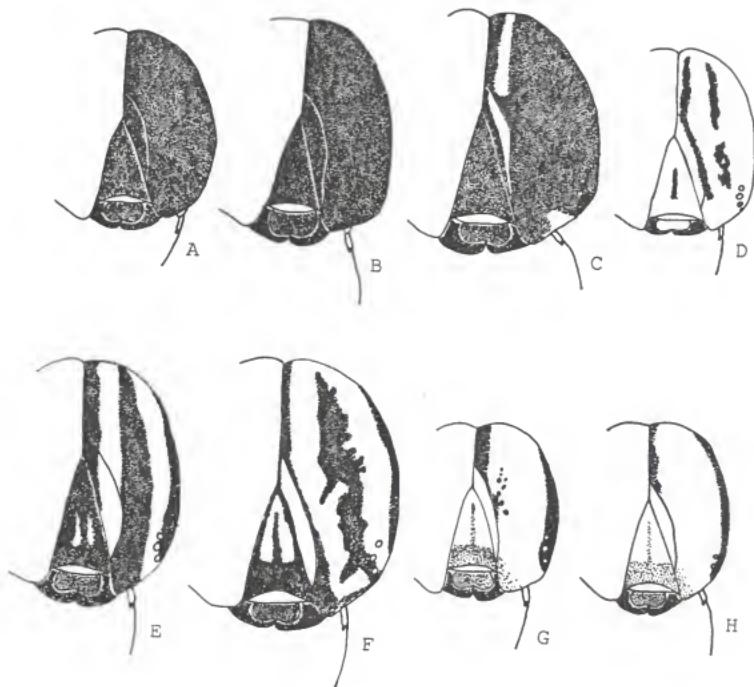


Figure 32. Frontal view of the larval head of *Wallengrenia otho* (A), *Pompeius verna* (B), *Atalopedes campestris* (C), *Atrytone arogos* (D), *A. delaware* (E), *Problema byssus* (F), *Ochlodes sylvanoides* (G), and *Ochlodes agricola* (H). All drawings are enlarged 12 times.

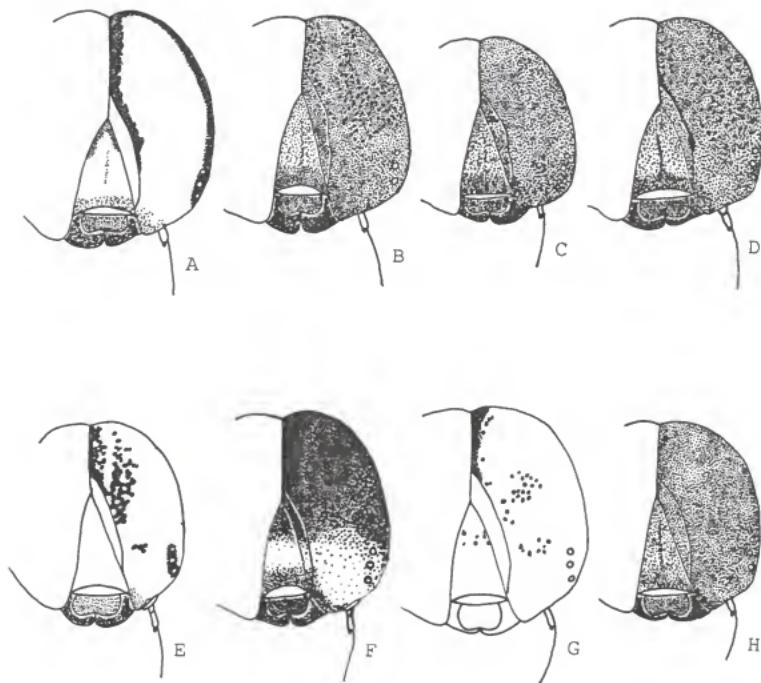


Figure 33. Frontal view of the larval head of *Ochlodes yuma* (A), *Poanes hobomok* (B), *P. zabulon* (C), *P. taxiles* (D), *P. aaroni* (E), *P. yehl* (F), *P. viator* (G), and *Paratrytone melane* (H). All drawings are enlarged 12 times.

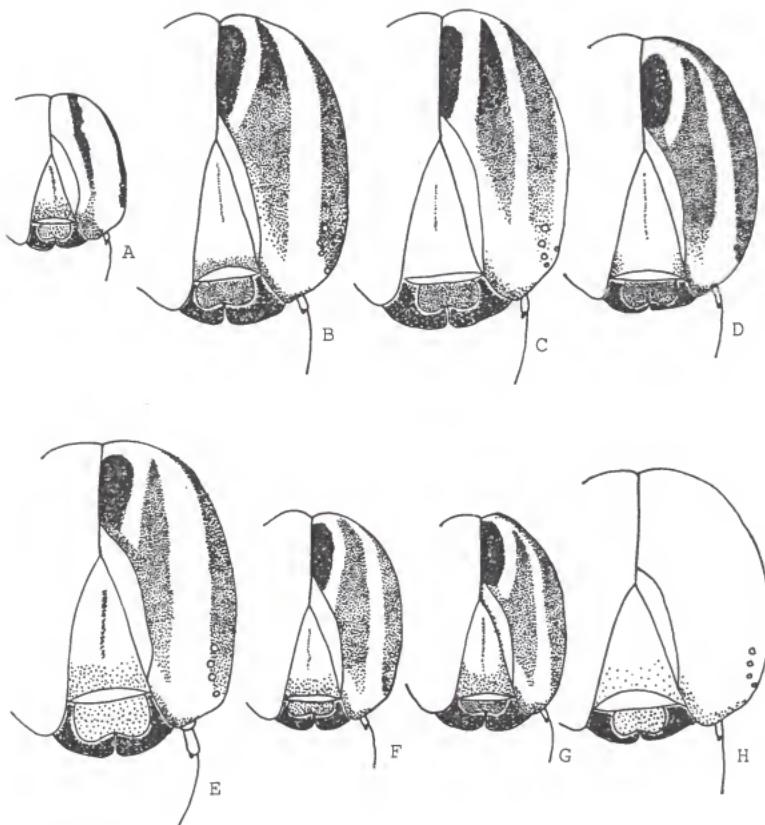


Figure 34. Frontal view of the larval head of *Choranthus haitensis* (A), *Euphyes arpa* (B), *E. pilatka* (C), *E. alabamae* (D), *E. dukesi* (E), *E. bimacula* (F), *E. ruricola* (G), and *Asbolis capucinus* (H). All drawings are enlarged 12 times.

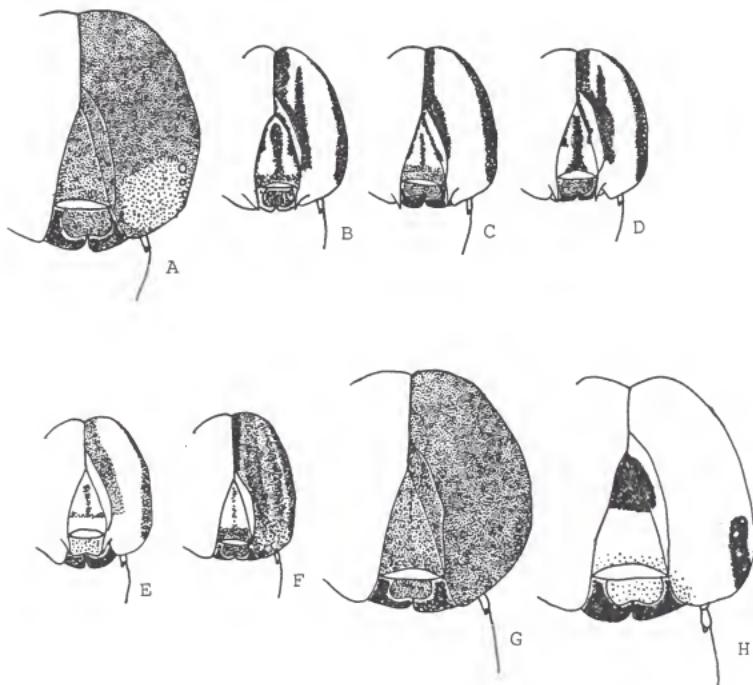


Figure 35. Frontal view of the larval head of *Atrytonopsis hianna* (A), *Amblyscirtes linda* (B), *A. aesculapias* (C), *A. vialis* (D), *A. celia* (E), *Lerodea eufala* (F), *Oligoria maculata* (G), and *Calpodes ethlius* (H). All drawings are enlarged 12 times.

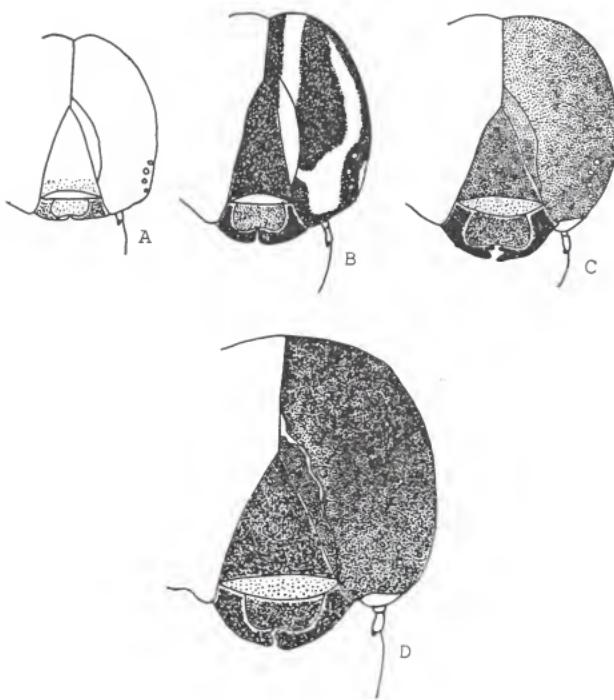


Figure 36. Frontal view of the larval head of *Panoquina panoquin* (A), *Nyctelius nyctelius* (B), *Agathymus valverdiensis* (C), and *Megathyimus yuccae* (D). All drawings are enlarged 12 times.

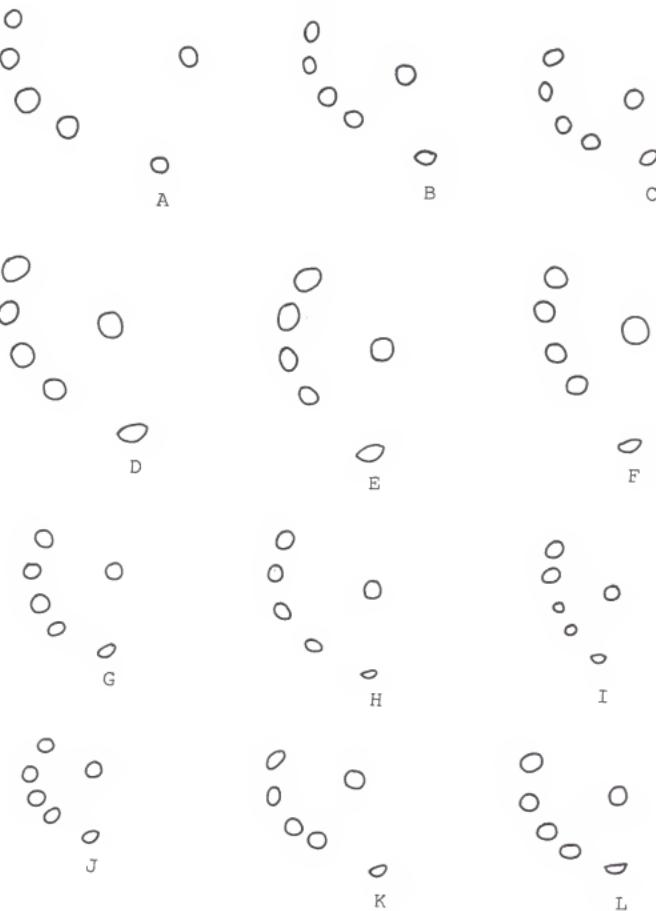


Figure 37. Stemmatical pattern of *Pyrrhopyge araxes* (A), *Phocides pigmalion* (B), *P. palemon* (C), *Epagyreus zestos* (D), *E. clarus* (E), *E. exadeus* (F), *Polygonus leo* (G), *Chioides catillus* (H), *Typhedanus undulatus* (I), *Polythrix mexicana* (J), *P. procera* (K), and *Codatractus alcaeus* (L). All drawings are enlarged 25 times.

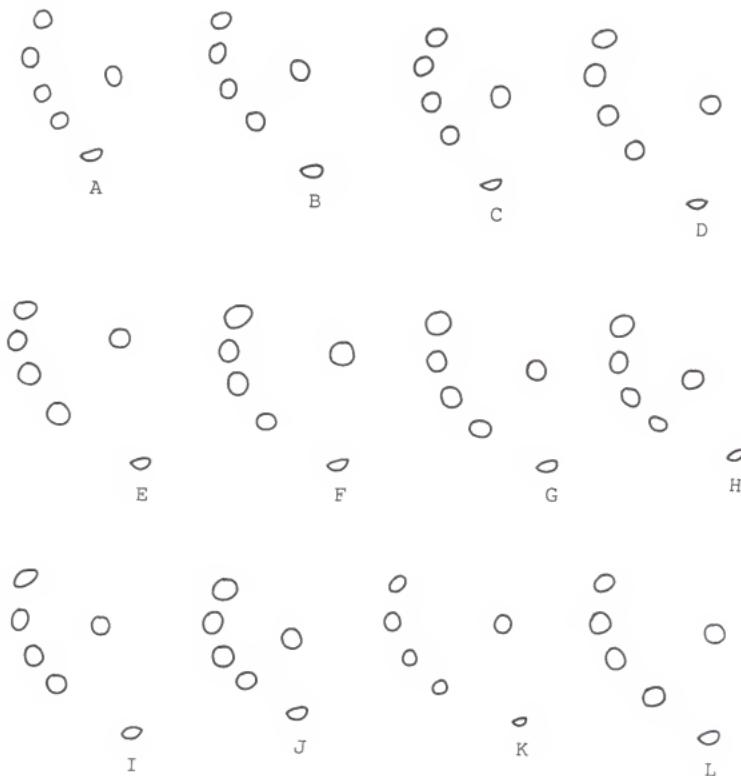


Figure 38. Stemmatal pattern of *Codatractus arizonicensis* (A), *Urbanus proteus* (B), *U. esmeraldus* (C), *U. dorantes* (D), *U. teleus* (E), *U. procne* (F), *Astraptes fulgerator* (G), *A. gilberti* (H), *A. anaphus* (I), *Autochton cellus* (J), *Achalarus lyciades* (K), and *A. casica* (L). All drawings are enlarged 25 times.

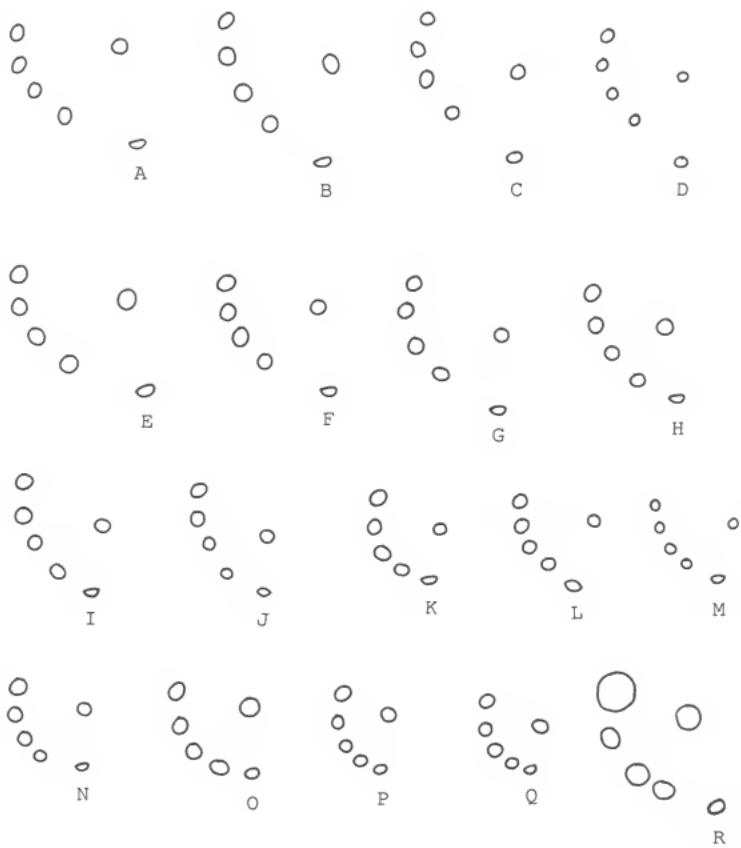


Figure 39. Stemmatal pattern of *Thorybes bathyllus* (A), *T. pylades* (B), *T. diversus* (C), *T. mexicanus* (D), *T. confusis* (E), *T. drusius* (F), *Cabares potrillo* (G), *Cogia hippalus* (H), *C. outis* (I), *C. caicus* (J), *Nisoniades rubescens* (K), *Staphylus mazans* (L), *S. hayhurstii* (M), *Carrhenes canescens* (N), *Xenophanes trixus* (O), *Systasea pulverulenta* (P), *S. zampa* (Q), and *Achlyodes thraso* (R). All drawings are enlarged 25 times.

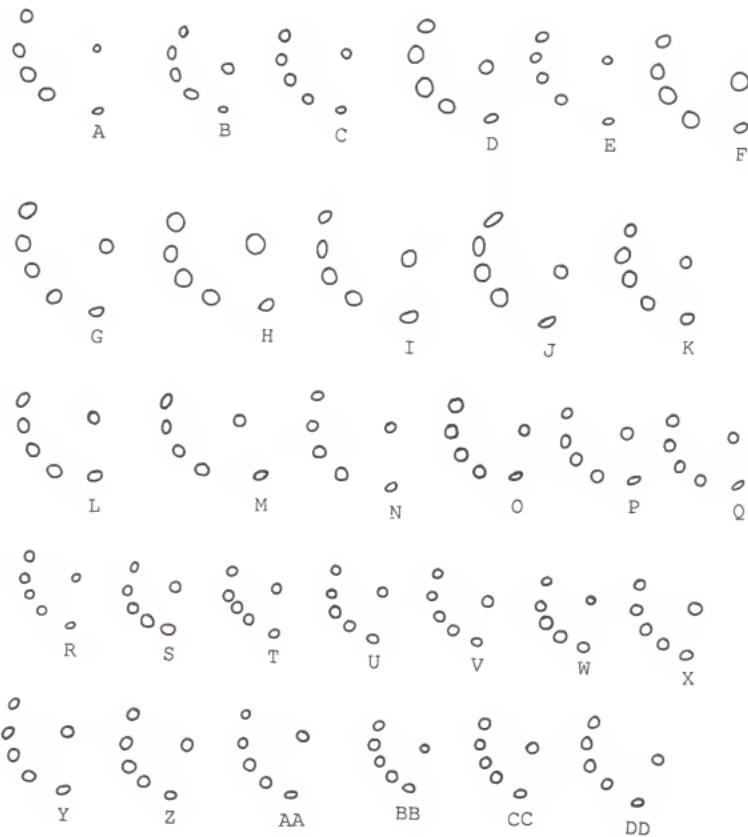


Figure 40. Stemmatal pattern of *Timochares ruptifasciatus* (A), *Chiomara asychis* (B), *Gesta gesta* (C), *Ephyriades brunneus* (D), *Erynnis icelus* (E), *E. brizo* (F), *E. juvenalis* (G), *E. propertius* (H), *E. horatius* (I), *E. tristis* (J), *E. martialis* (K), *E. pacuvius* (L), *E. zarucco* (M), *E. funeralis* (N), *E. baptisiae* (O), *E. afranius* (P), *E. persius* (Q), *Pyrgus centaureae* (R), *P. ruralis* (S), *P. scriptura* (T), *P. communis* (U), *P. albescens* (V), *P. oileus* (W), *Helioptetes ericetorum* (X), *H. lavianus* (Y), *H. macaira* (Z), *H. arsalte* (AA), *Celotes nessus* (BB), *C. limpa* (CC), and *Pholisora catullus* (DD). All drawings are enlarged 25 times.

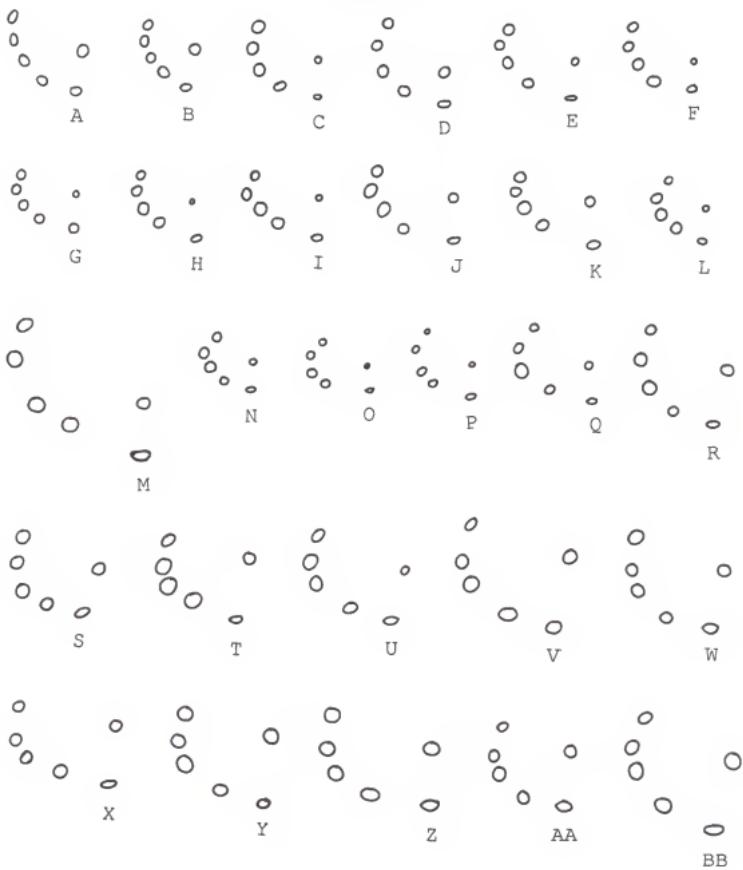


Figure 41. Stemmatal pattern of *Pholisor a alpheus* (A), *P. gracielae* (B), *Piruna pirus* (C), *Synapte malitiosa* (D), *Vidius perigenes* (E), *Nastra lherminier* (F), *N. julia* (G), *N. neamatethla* (H), *Cymaenes tripunctus* (I), *Lerema accius* (J), *L. liris* (K), *Ancyloxypha numitor* (L), *Perichares philetus* (M), *A. arene* (N), *Copaeodes aurantiacus* (O), *C. minimus* (P), *Thymelicus lineola* (Q), *Hylephila phyleus* (R), *Yvretta carus* (S), *Pseudocopaeodes eunus* (T), *Hesperia uncas* (U), *H. juba* (V), *H. comma* (W), *H. woodgatei* (X), *H. leonardus* (Y), *H. pahaska* (Z), *H. metea* (AA), and *H. viridis* (BB). All drawings are enlarged 25 times.

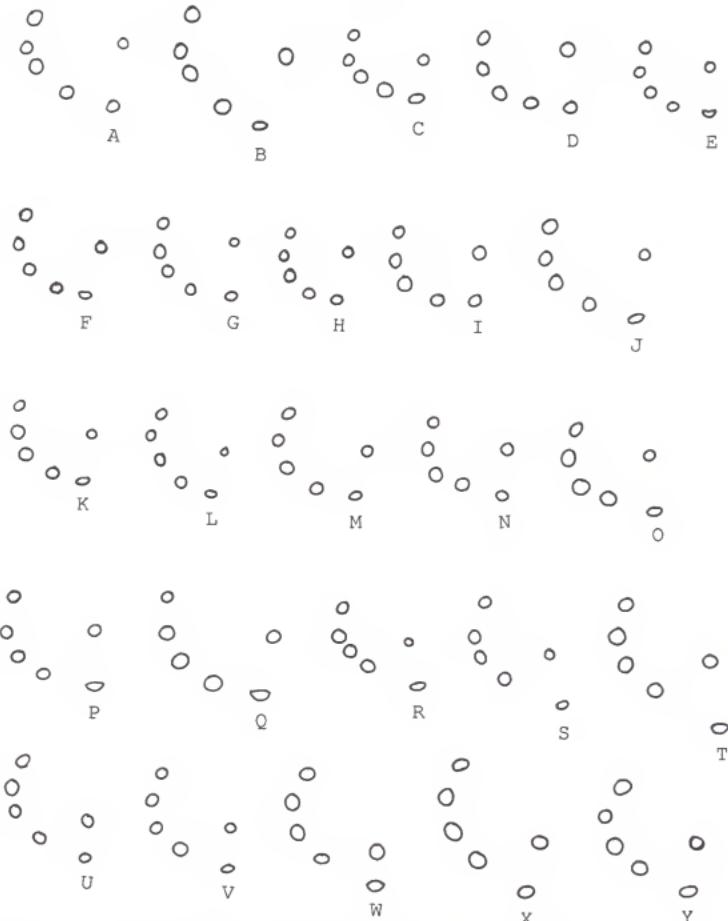


Figure 42. Stemmatal pattern of *Hesperia attalus* (A), *H. meskei* (B), *H. nevada* (C), *Polites coras* (D), *P. sabuleti* (E), *P. mardon* (F), *P. draco* (G), *P. baracoa* (H), *P. themistocles* (I), *P. origenes* (J), *P. mystic* (K), *P. sonora* (L), *P. vibex* (M), *Wallengrenia otho* (N), *W. egeremet* (O), *Pompeius verna* (P), *Atalopedes campestris* (Q), *Atrytone arogos* (R), *A. delaware* (S), *Problema byssus* (T), *Ochlodes sylvanoides* (U), *O. agricola* (V), *O. yuma* (W), *Poanes hobomok* (X), and *P. zabulon* (Y). All drawings are enlarged 25 times.

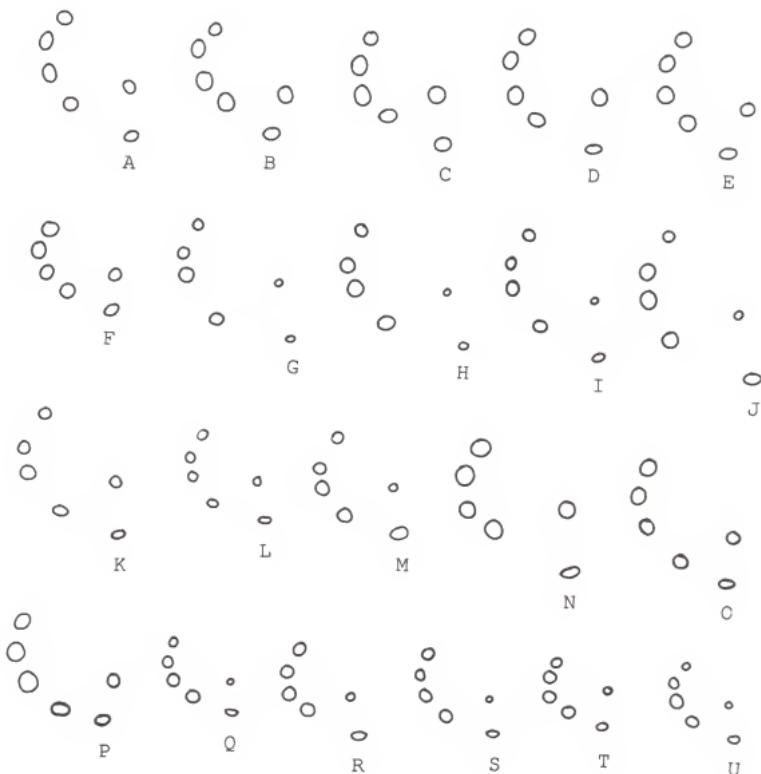


Figure 43. Stemmatal pattern of *Poanes taxiles* (A), *P. aaroni* (B), *P. yehl* (C), *P. viator* (D), *Paratrytone melane* (E), *Choranthus haitensis* (F), *Euphyes arpa* (G), *E. pilatka* (H), *E. alabamae* (I), *E. dukesi* (J), *E. macguirei* (K), *E. bimacula* (L), *E. ruricola* (M), *Asbolis capucinus* (N), *Atrytonopsis hianna* (O), *A. loammi* (P), *Amblyscirtes linda* (Q), *A. aesculapias* (R), *A. vialis* (S), *A. celia* (T), and *Lerdeoa eufala* (U). All drawings are enlarged 25 times.

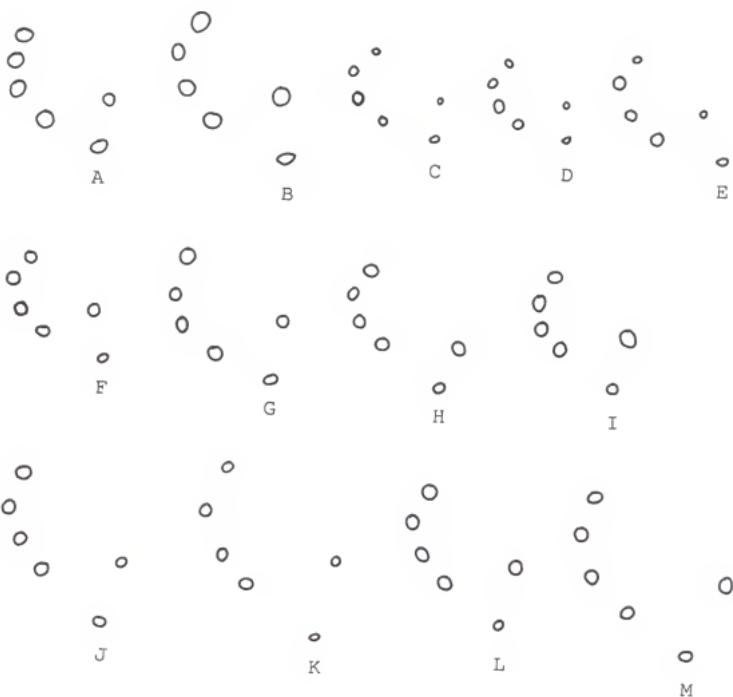


Figure 44. Stemmatal pattern of *Oligoria maculata* (A), *Calpodes ethlius* (B), *Panoquina panoquin* (C), *P. panoquinoides* (D), *P. ocola* (E), *P. sylvicola* (F), *Nyctelius nyctelius* (G), *Agathymus valverdiensis* (H), *A. stephensi* (I), *Megathymus yuccae* (J), *M. coloradensis* (K), *M. cofaqui* (L), and *M. ursus* (M). All drawings are enlarged 25 times.

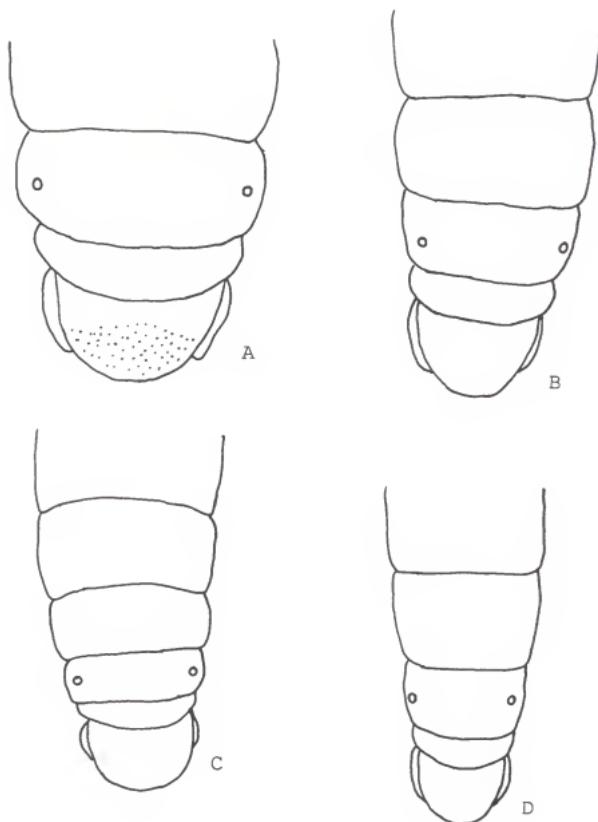


Figure 45. Dorsal view of the larval terminalia of *Pyrrhopyge araxes* (A), *Phocides pigmalion* (B), *Epargyreus zestos* (C), and *Polygonus leo* (D). All drawings are enlarged six times.

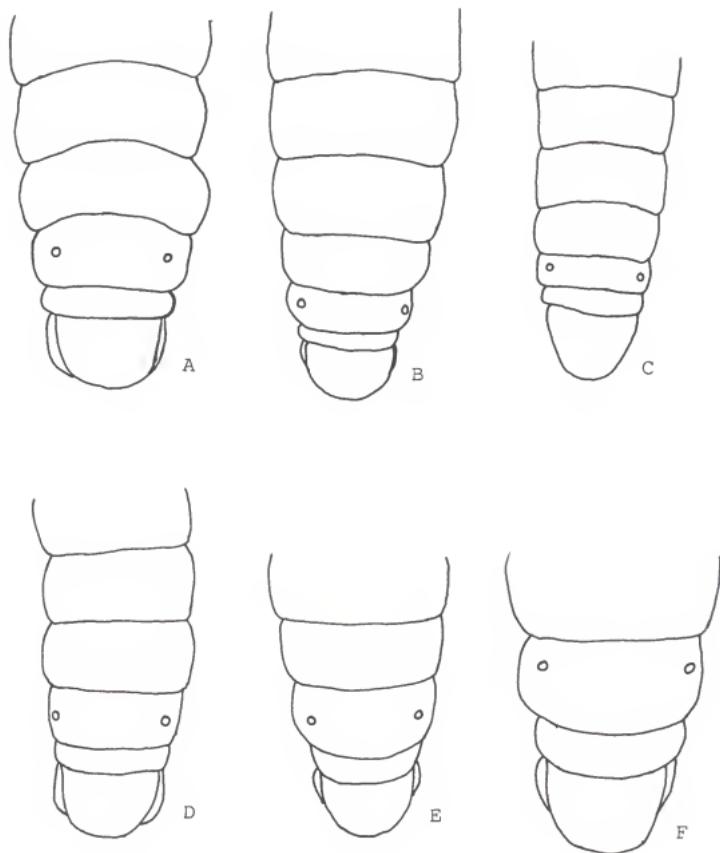


Figure 46. Dorsal view of the larval terminalia of *Chiooides catillus* (A), *Typhedanus undulatus* (B), *Polythrix mexicana* (C), *Codatractus alcaeus* (D), *Urbanus proteus* (E), and *Astraptes fulgerator* (F). All drawings are enlarged six times.

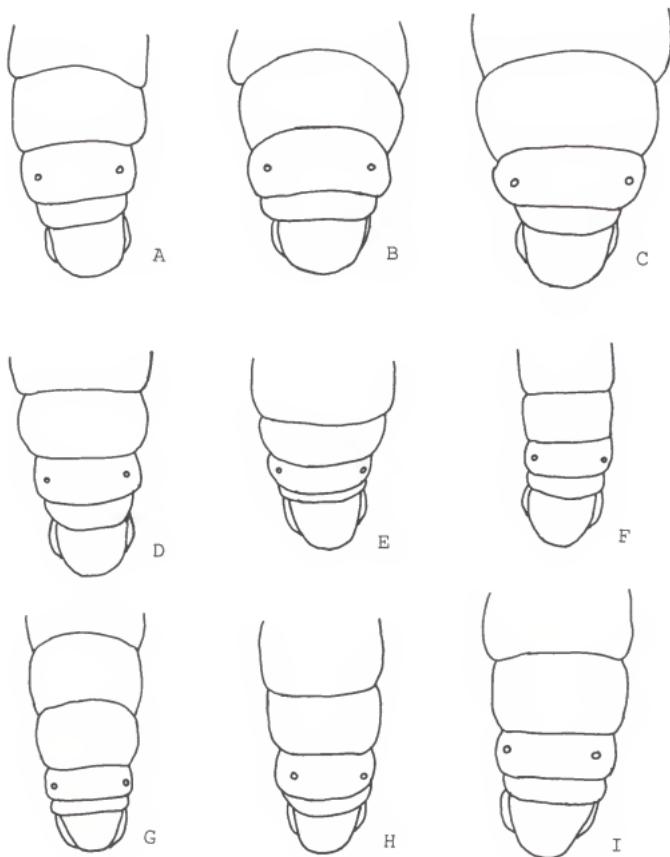


Figure 47. Dorsal view of the larval terminalia of *Autochton cellus* (A), *Achalarus lyciades* (B), *Thorybes bathyllus* (C), *Cabares potrillo* (D), *Cogia hippalus* (E), *Nisoniades rubescens* (F), *Staphylus ceos* (G), *Carrhenes canescens* (H), and *Xenophanes trixus* (I). All drawings are enlarged six times.

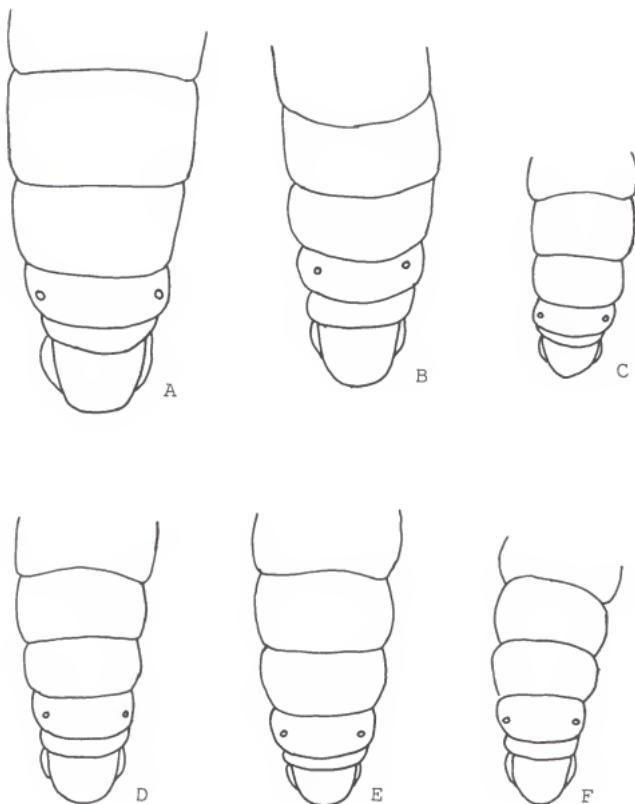


Figure 48. Dorsal view of the larval terminalia of *Achlyodes thraso* (A), *Timochares ruptifasciatus* (B), *Gesta gesta* (C), *Ephyriades brunneus* (D), *Erynnis icelus* (E), and *Pyrgus centaureae* (F). All drawings are enlarged six times.

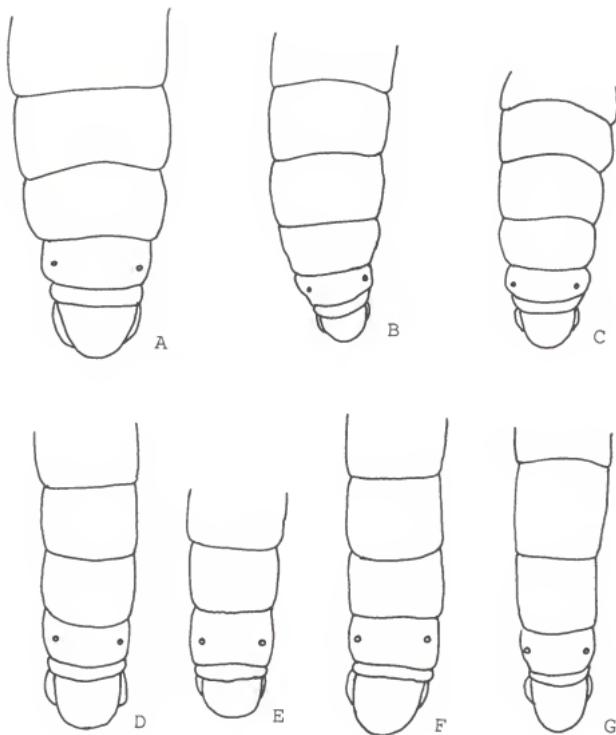


Figure 49. Dorsal view of the larval terminalia of *Helioptetes ericetorum* (A), *Celotes nessus* (B), *Pholisora catullus* (C), *Piruna pirus* (D), *Synapte malitiosa* (E), *Vidius perigenes* (F), and *Nastra lherminier* (G). All drawings are enlarged six times.

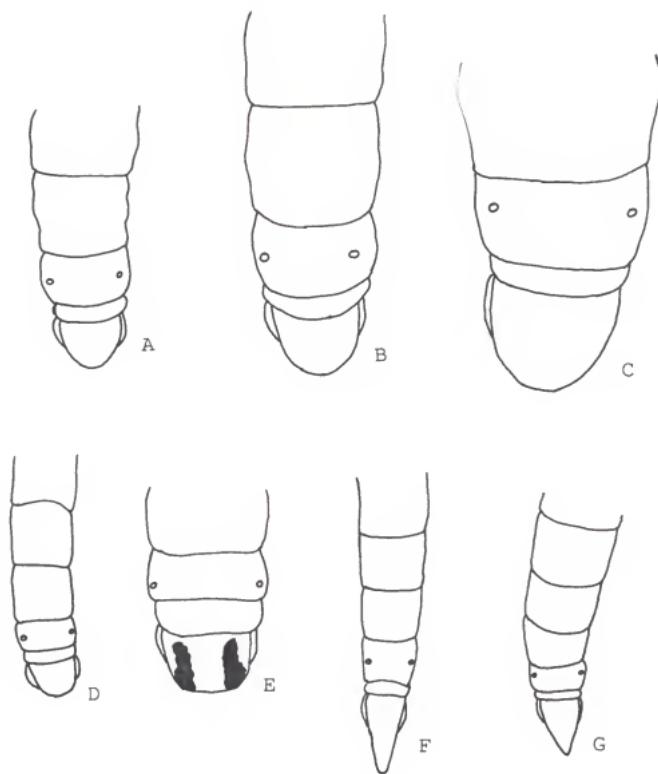


Figure 50. Dorsal view of the larval terminalia of *Cymaenes tripunctus* (A), *Lerema accius* (B), *Perichares philetetes* (C), *Ancyloxypha numitor* (D), *A. arene* (E), *Copaeodes aurantiacus* (F), and *C. minimus* (G). Drawings D and F-G are enlarged 6 times; E is enlarged 12 times.

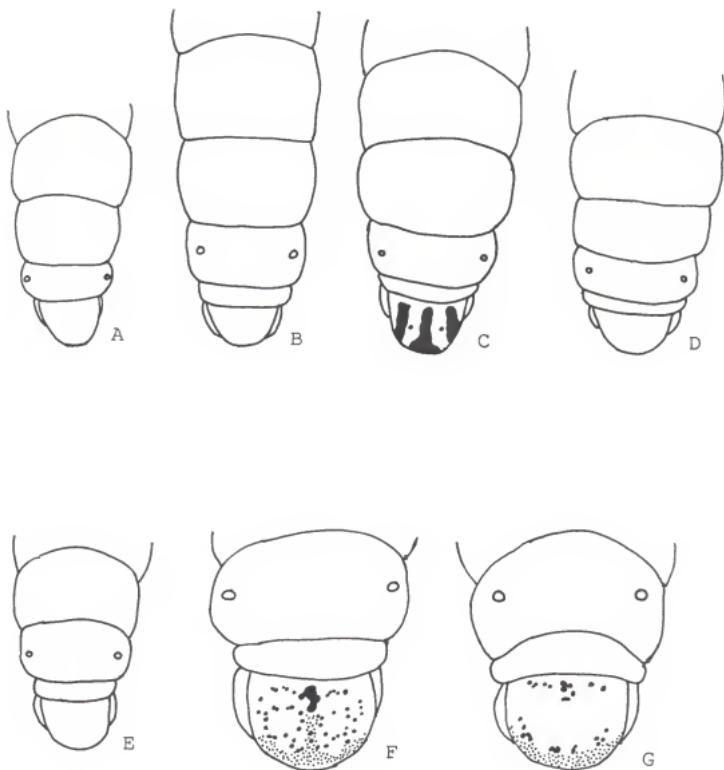


Figure 51. Dorsal view of the larval terminalia of *Thymelicus lineola* (A), *Hylephila phyleus* (B), *Yvretta carus* (C), *Pseudocopaeodes eunus* (D), *Hesperia uncas* (E), *Polites coras* (F), and *P. sabuleti* (G). Drawings A-E are enlarged 6 times; F and G are enlarged 12 times.

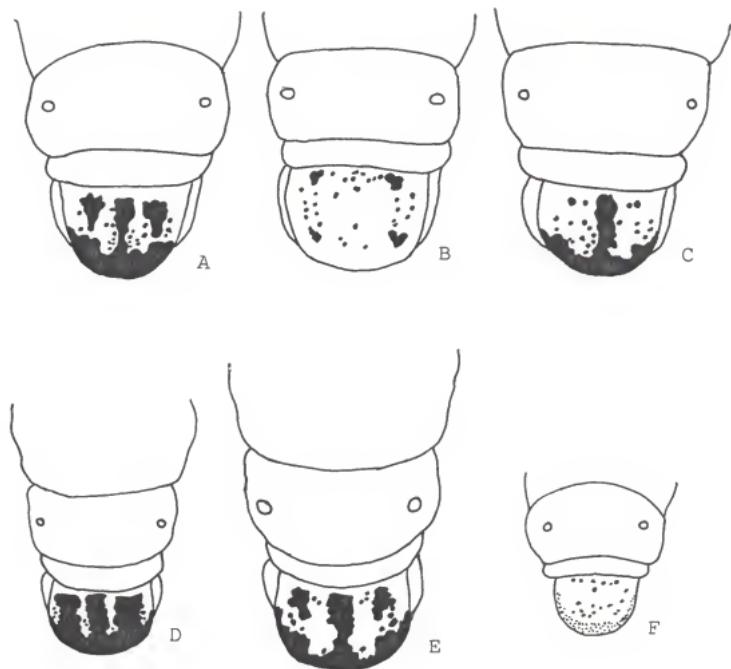


Figure 52. Dorsal view of the larval terminalia of *Polites sabuleti* (A), *P. mardon* (B), *P. draco* (C), *P. baracoa* (D), *P. themistocles* (E), and *P. origenes* (F). Drawings A-E are enlarged 12 times; F is enlarged 6 times.

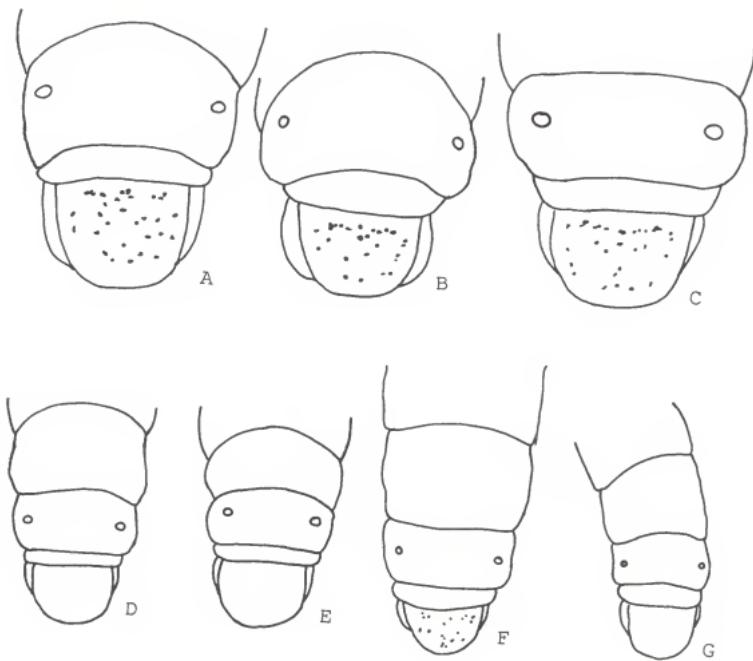


Figure 53. Dorsal view of the larval terminalia of *Polites mystic* (A), *P. sonora* (B), *P. vibex* (C), *Wallengrenia otho* (D), *Pompeius verna* (E), *Atalopedes campestris* (F), and *Atrytone arogos* (G). Drawings A-C are enlarged 12 times; D-G are enlarged 6 times.

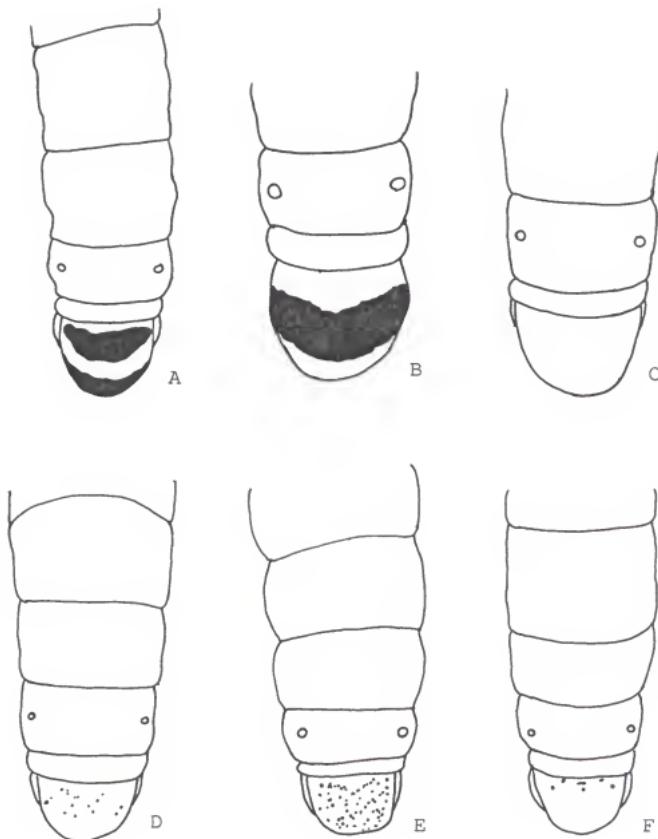


Figure 54. Dorsal view of the larval terminalia of *Atrytone delaware* (A), third instar *Problema byssus* (B), last instar *Problema byssus* (C), *Ochlodes yuma* (D), *Poanes hobomok* (E), and *Paratrytone melane* (F). Drawings A and C-F are enlarged 6 times; B is enlarged 12 times.

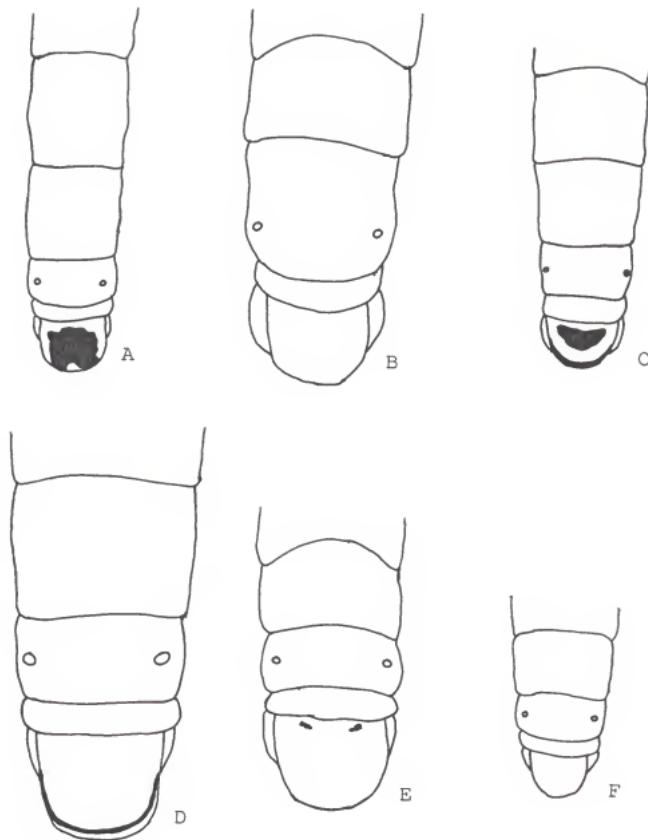


Figure 55. Dorsal view of the larval terminalia of *Choranthus haitensis* (A), *Euphyes arpa* (B), *E. ruricola* (C), *Asbolis capucinus* (D), *Atrytonopsis hianna* (E), and *Amblyscirtes linda* (F). All drawings are enlarged six times.

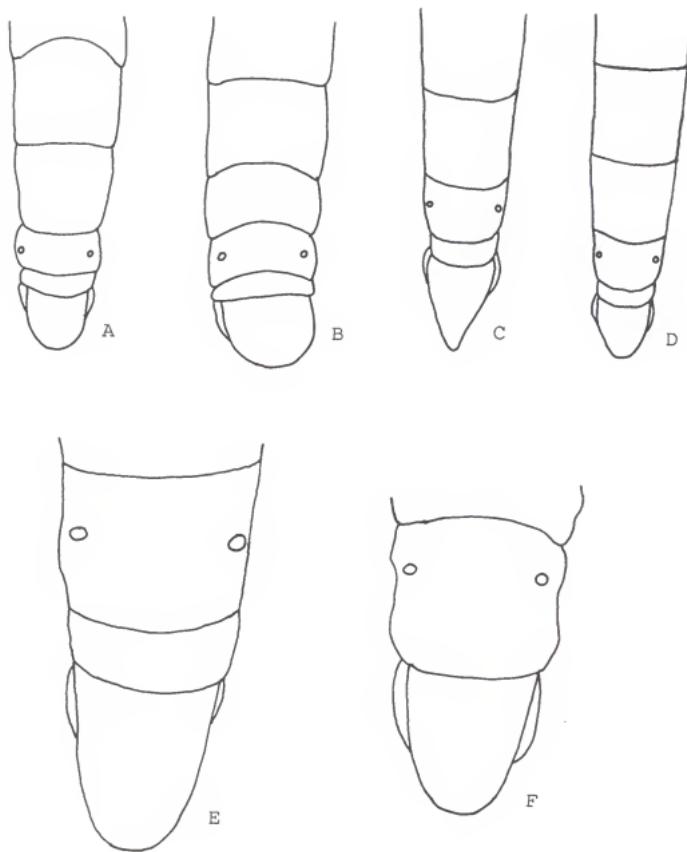


Figure 56. Dorsal view of the larval terminalia of *Lerodea eufala* (A), *Oligoria maculata* (B), *Panoquina panoquin* (C), *P. panoquinoides* (D), *P. ocola* (E), and *P. sylvicola* (F). Drawings A-D are enlarged 6 times; E-F are enlarged 12 times.

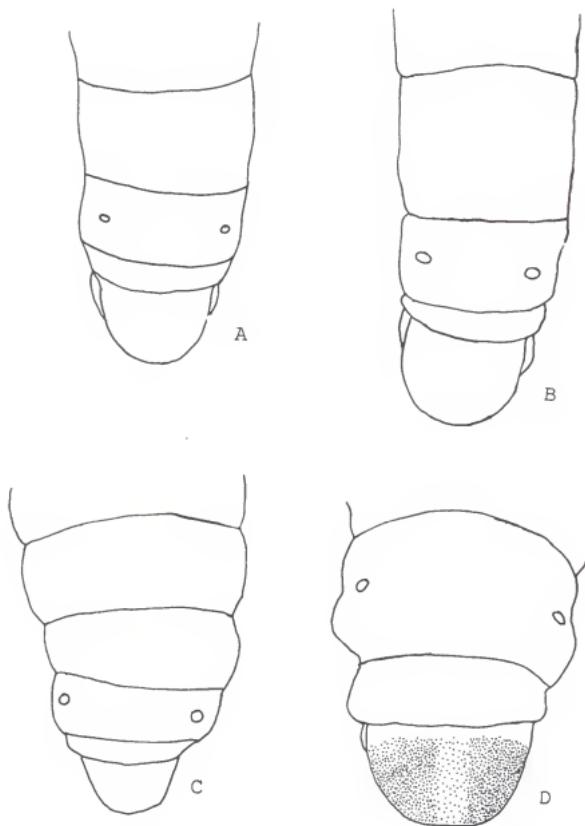


Figure 57. Dorsal view of the larval terminalia of *Nyctelius nyctelius* (A), *Calpodes ethlius* (B), *Agathymus valverdiensis* (C), and *Megathymus yuccae* (D). All drawings are enlarged six times.

Figure 58. Pupa of *Epargyreus clarus* (A), *Thorybes bathyllus* (B), *Urbanus proteus* (C), *Phocides pigmalion* (D), *Polygonus leo* (E), *Anastrus sempiternus* (F), *Achlyodes thraso* (G), and *Pyrgus communis* (H).

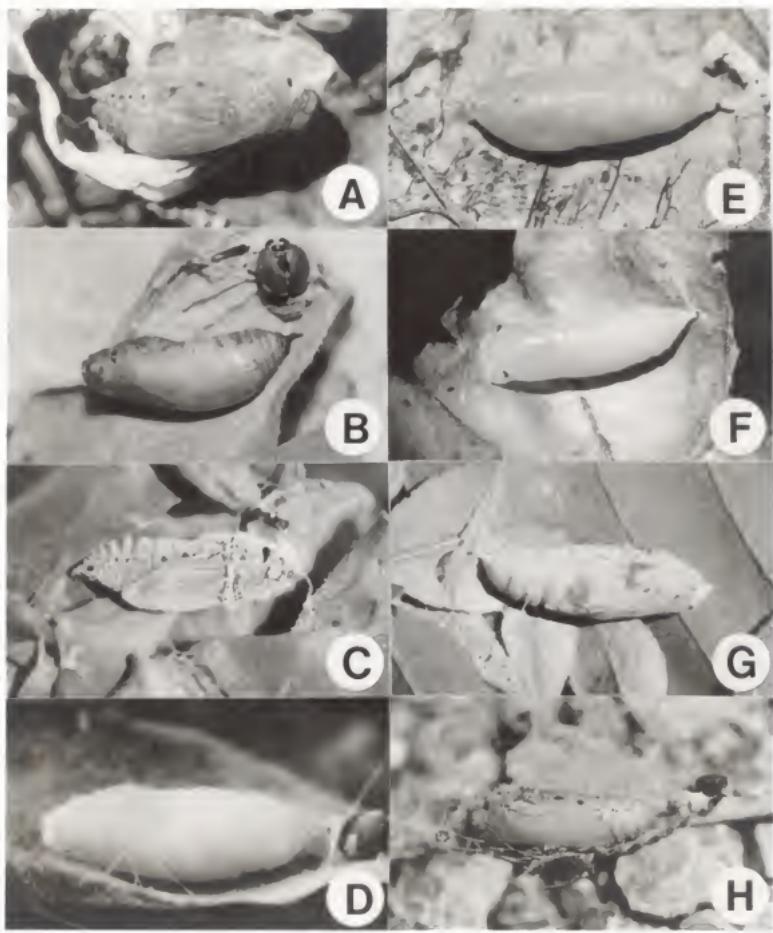


Figure 59. Pupa of *Hesperia attalus* (A), *Pompeius verna* (B), *Poanes yehl* (C), *Oligoria maculata* (D), *Cymaenes tripunctus* (E), and *Synapte malitiosa* (F).

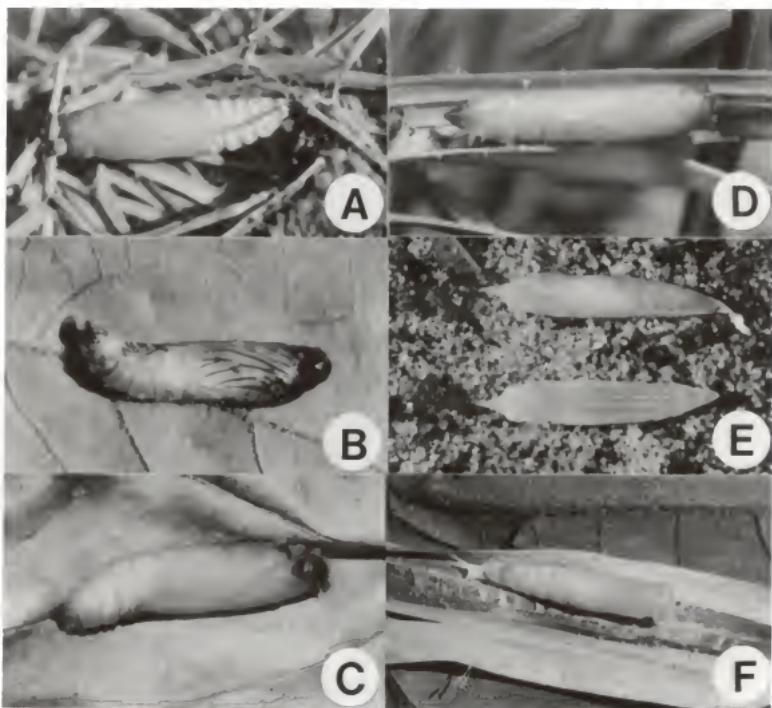
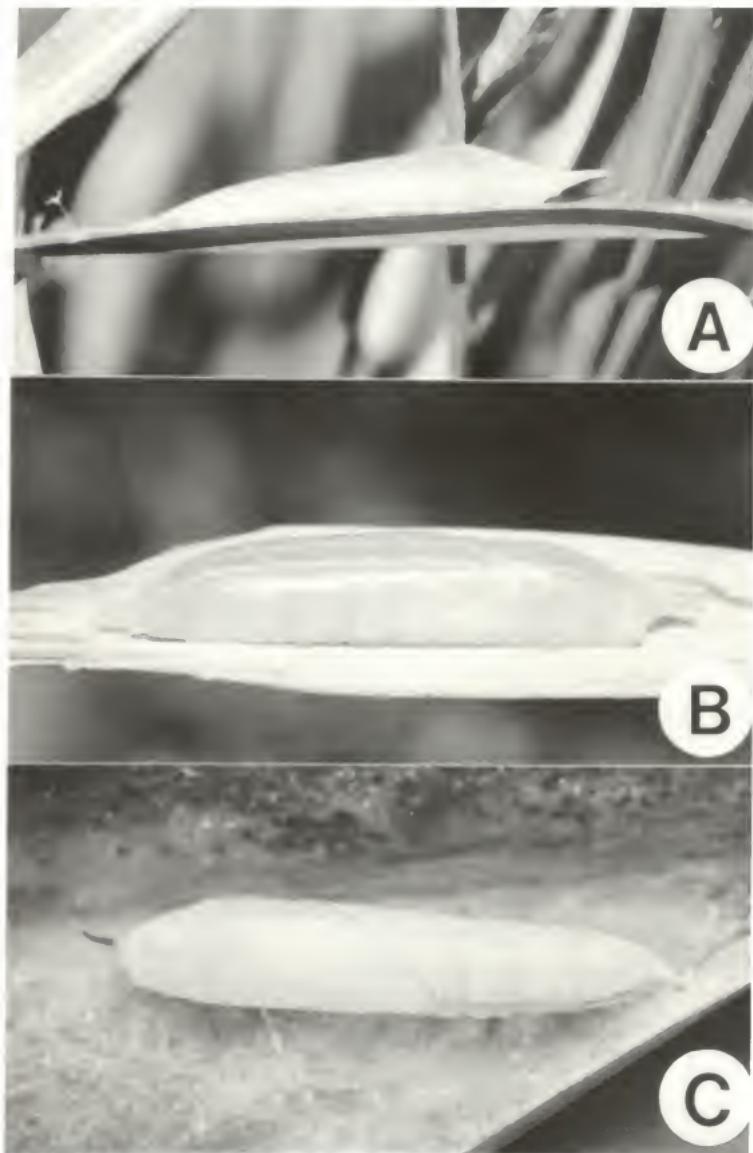


Figure 60. Pupa of *Nastra lherminier* (A), *Perichares philetas* (B), and *Calpodes ethlius* (C).



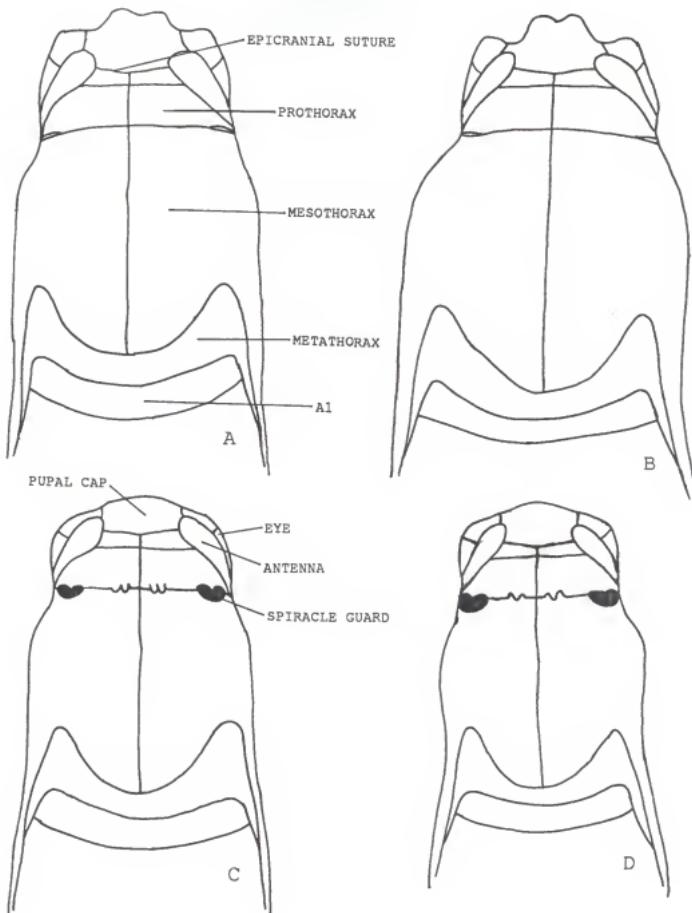


Figure 61. Dorsal view of anterior pupa of *Phocides pigmalion* (A), *P. palemon* (B), *Epargyreus zestos* (C), and *E. clarus* (D). All drawings are enlarged six times.

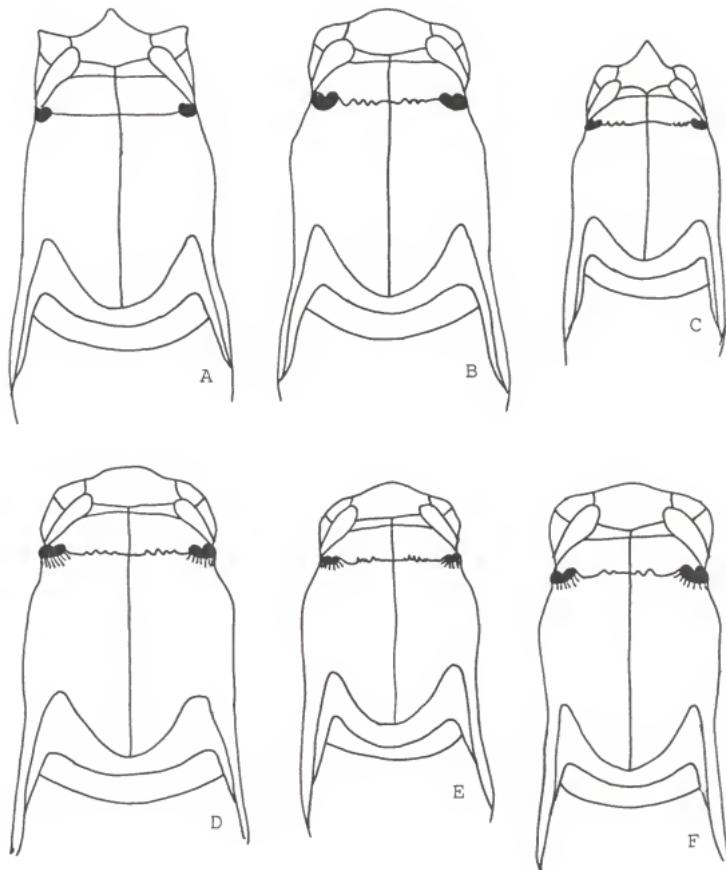


Figure 62. Dorsal view of anterior pupa of *Polygonus leo* (A), *Chioides catillus* (B), *Polythrix mexicanus* (C), *Codatractus alcaeus* (D), *C. arizonensis* (E), and *Urbanus proteus* (F). All drawings are enlarged six times.

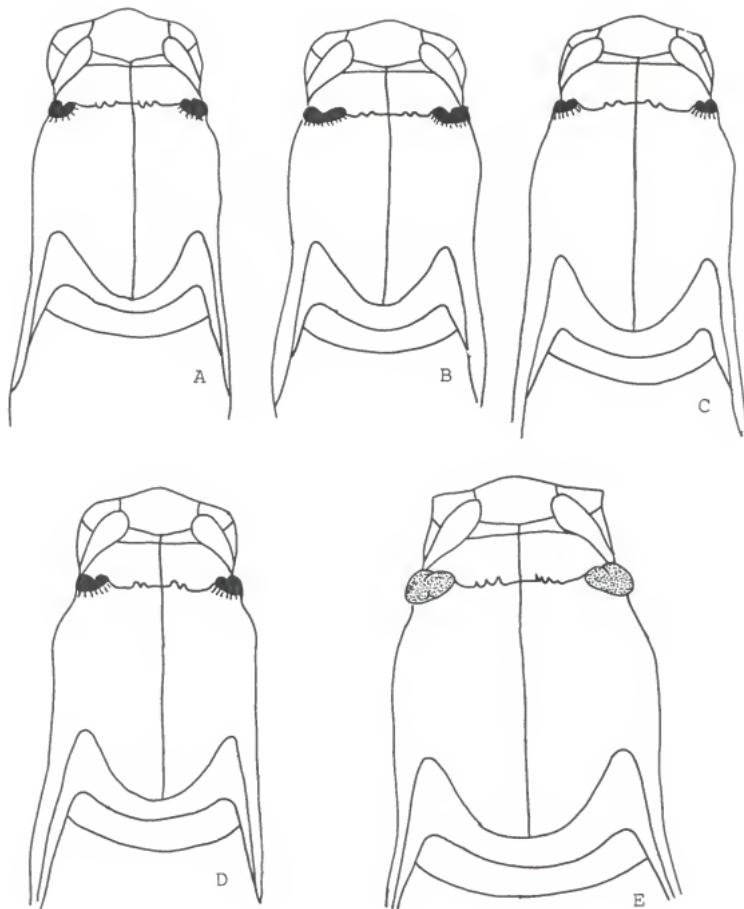


Figure 63. Dorsal view of anterior pupa of *Urbanus esmeraldus* (A), *U. dorantes* (B), *U. teleus* (C), *U. procne* (D), and *Astraptes fulgerator* (E). All drawings are enlarged six times.

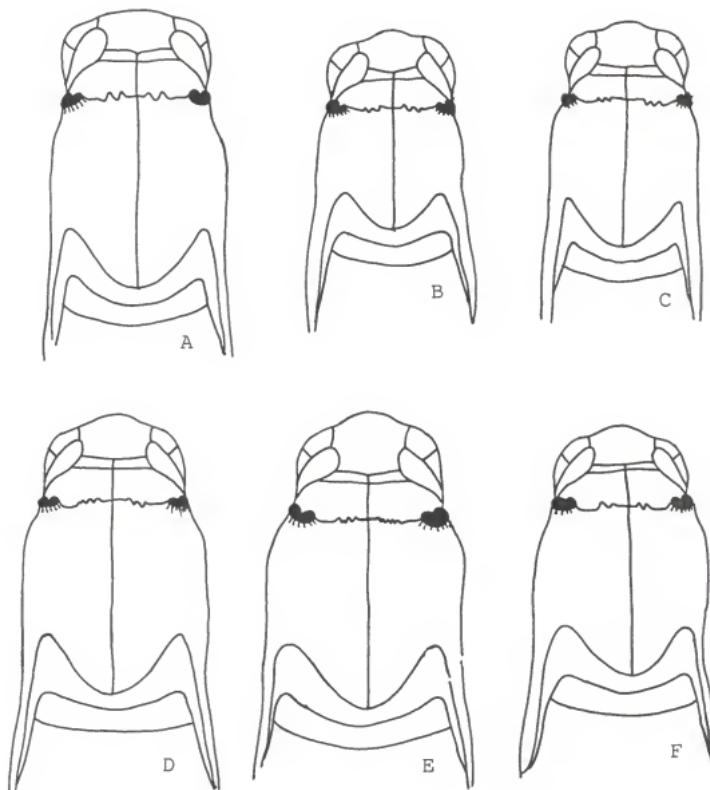


Figure 64. Dorsal view of anterior pupa of *Astraptes gilberti* (A), *Autochton cellus* (B), *Achalarus lyciades* (C), *Thorybes bathyllus* (D), *T. pylades* (E), and *T. confusis* (F). All drawings are enlarged six times.

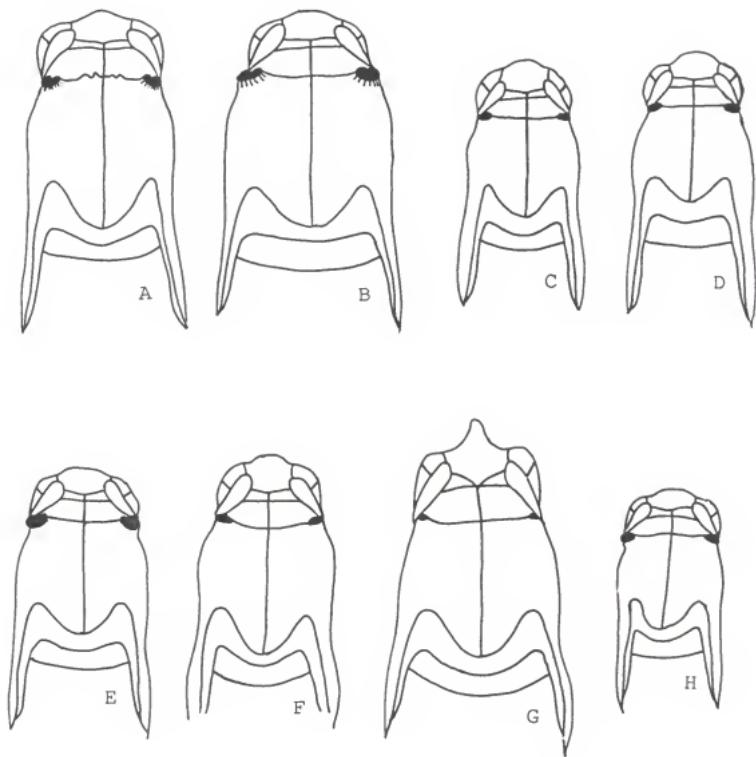


Figure 65. Dorsal view of anterior pupa of *Cabares potrillo* (A), *Cogia outis* (B), *Staphylus ceos* (C), *S. hayhurstii* (D), *Carrhenes canescens* (E), *Systasea pulverulenta* (F), *Achlyodes thraso* (G), and *Chiomara asychis* (H). All drawings are enlarged six times.

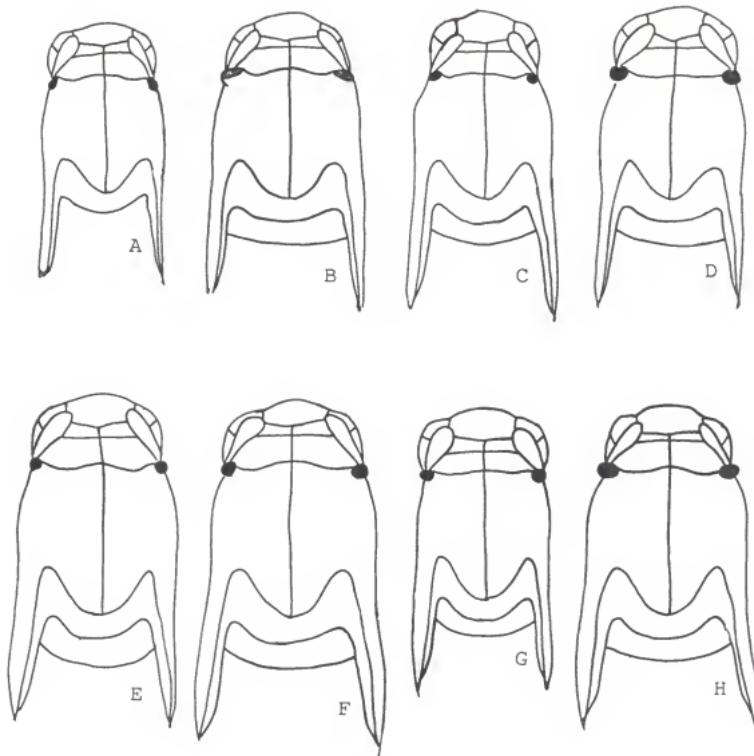


Figure 66. Dorsal view of anterior pupa of *Gesta gesta* (A), *Ephyriades brunneus* (B), *Erynnis icelus* (C), *E. brizo* (D), *E. juvenalis* (E), *E. horatius* (F), *E. tristis* (G), and *E. martialis* (H). All drawings are enlarged six times.

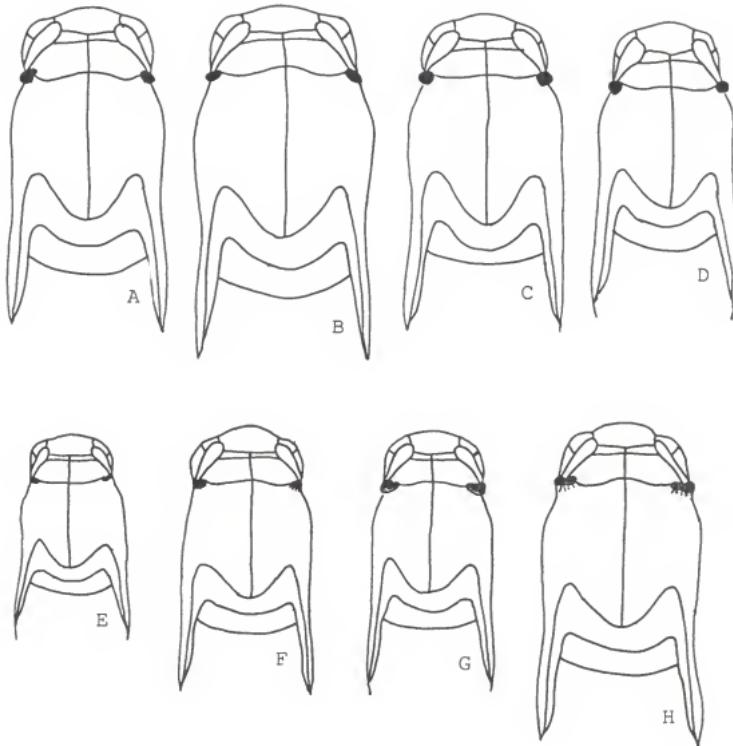


Figure 67. Dorsal view of anterior pupa of *Erynnis zarucco* (A), *E. funeralis* (B), *E. baptisiae* (C), *E. persius* (D), *Pyrgus scriptura* (E), *P. communis* (F), *P. oileus* (G), and *Helioptetes ericetorum* (H). All drawings are enlarged six times.

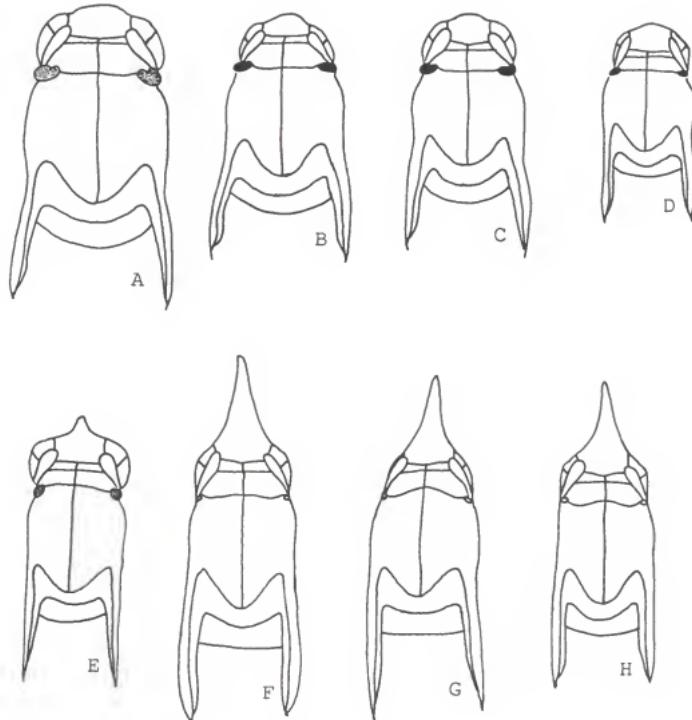


Figure 68. Dorsal view of anterior pupa of *Helioptetes lavianus* (A), *Celotes nessus* (B), *Pholisora catullus* (C), *P. alpheus* (D), *Synapte malitiosa* (E), *Nastra lherminier* (F), *N. julia* (G), and *N. neamathla* (H). All drawings are enlarged six times.

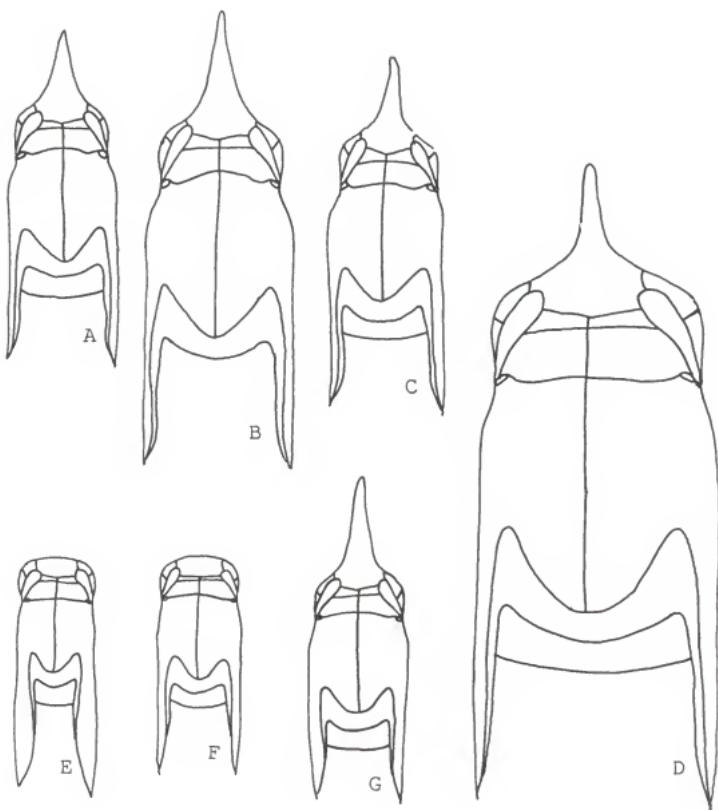


Figure 69. Dorsal view of anterior pupa of *Cymaenes tripunctus* (A), *Lerema accius* (B), *L. liris* (C), *Perichares philetetes* (D), *Ancyloxypha numitor* (E), *A. arene* (F), and *Copaeodes aurantiacus* (G). All drawings are enlarged six times.

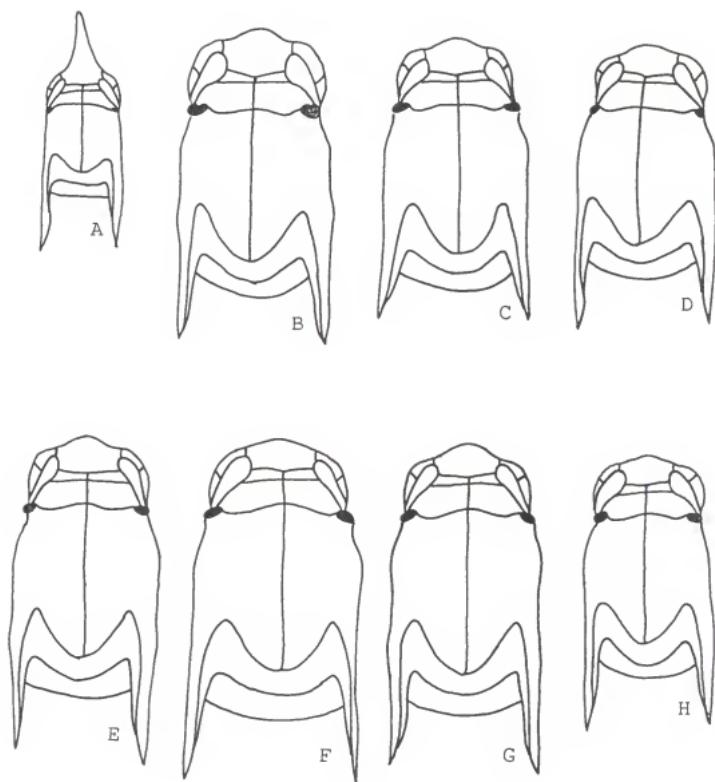


Figure 70. Dorsal view of anterior pupa of *Copaeodes minimus* (A), *Hylephila phyleus* (B), *Yvretta carus* (C), *Pseudocopaeodes eunus* (D), *Hesperia uncas* (E), *H. comma* (F), *H. attalus* (G), and *Polites coras* (H). All drawings are enlarged six times.

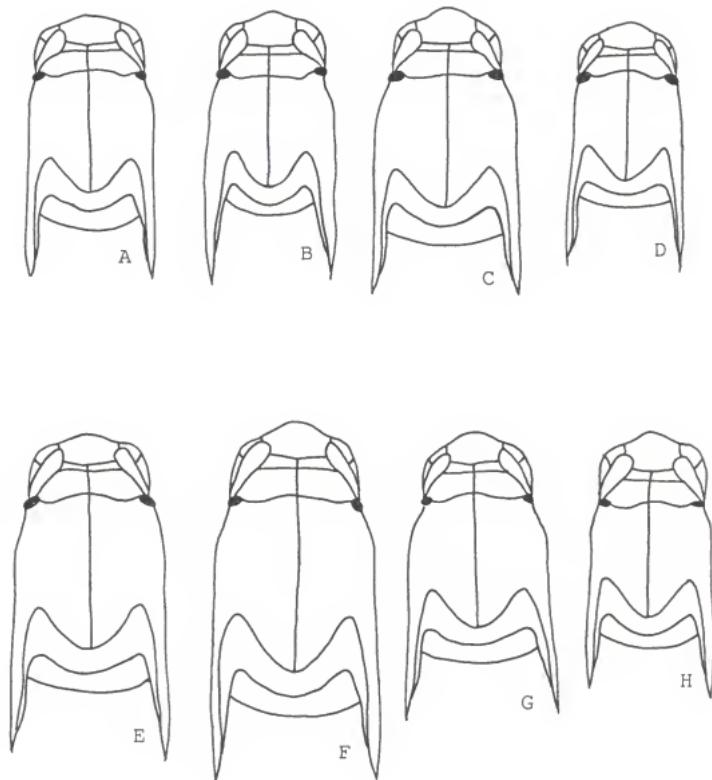


Figure 71. Dorsal view of anterior pupa of *Polites sabuleti* (A), *P. mardon* (B), *P. draco* (C), *P. baracoa* (D), *P. themistocles* (E), *P. origenes* (F), *P. mystic* (G), and *P. sonora* (H). All drawings are enlarged six times.

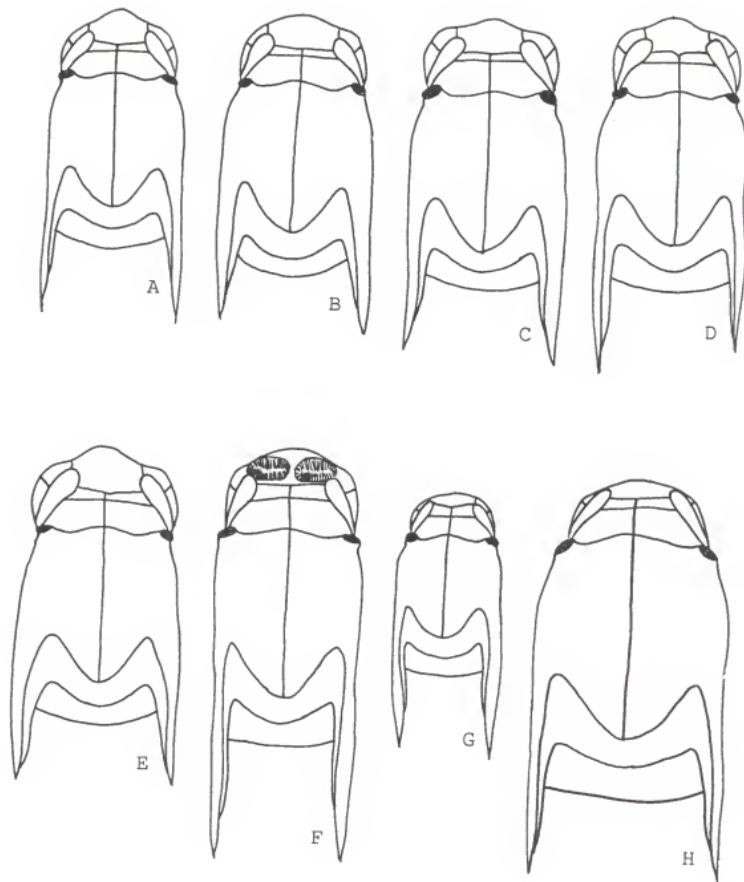


Figure 72. Dorsal view of anterior pupa of *Polites vibex* (A), *Wallengrenia otho* (B), *W. egeremet* (C), *Pompeius verna* (D), *Atalopedes campestris* (E), *Atrytone delaware* (F), *A. argos* (G), and *Problema byssus* (H). All drawings are enlarged six times.

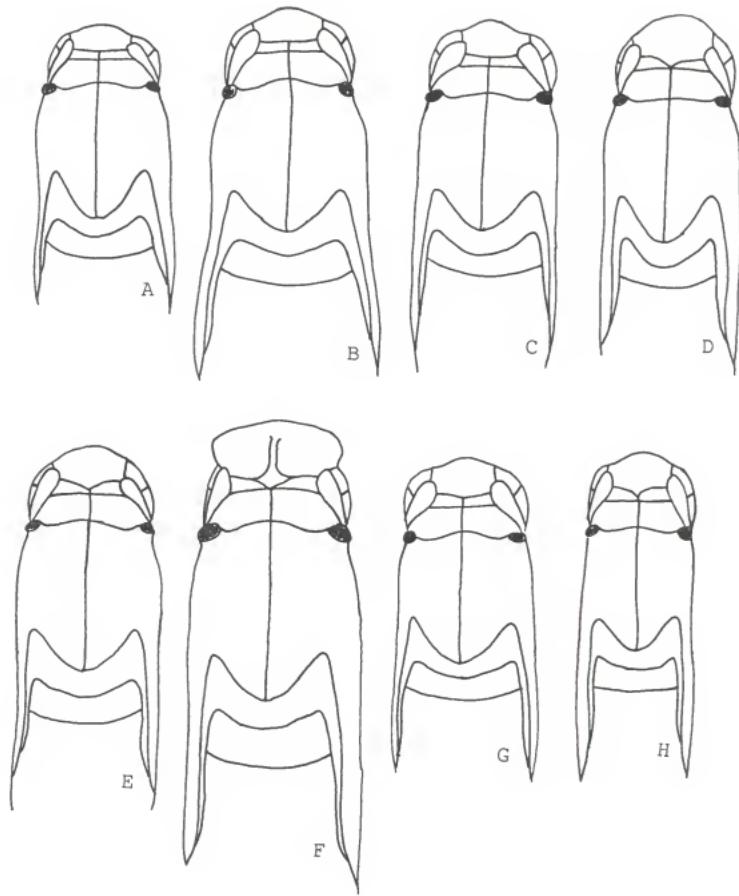


Figure 73. Dorsal view of anterior pupa of *Ochlocles sylvanoides* (A), *Poanes hobomok* (B), *P. taxiles* (C), *P. aaroni* (D), *P. yehl* (E), *P. viator* (F), *Paratrytone melane* (G), and *Choranthus haitensis* (H). All drawings are enlarged six times.

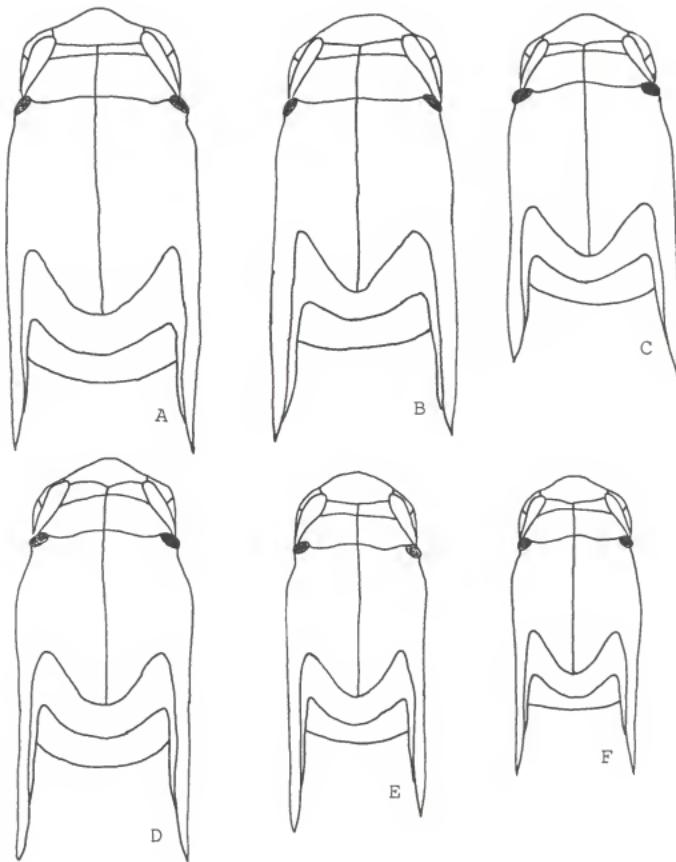


Figure 74. Dorsal view of anterior pupa of *Euphyes arpa* (A), *E. pilatka* (B), *E. alabamae* (C), *E. dukesii* (D), *E. berryi* (E), and *E. bimacula* (F). All drawings are enlarged six times.

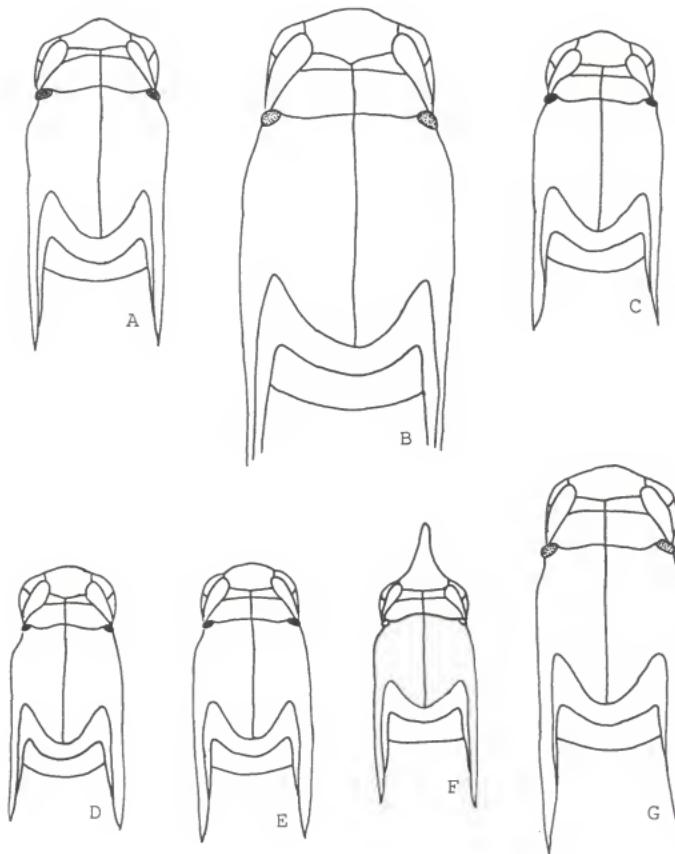


Figure 75. Dorsal view of anterior pupa of *Euphyes ruricola* (A), *Asbolis capucinus* (B), *Atrytonopsis loammi* (C), *Amblyscirtes aesculapias* (D), *A. celia* (E), *Lerodea eufala* (F), and *Oligoria maculata* (G). All drawings are enlarged six times.

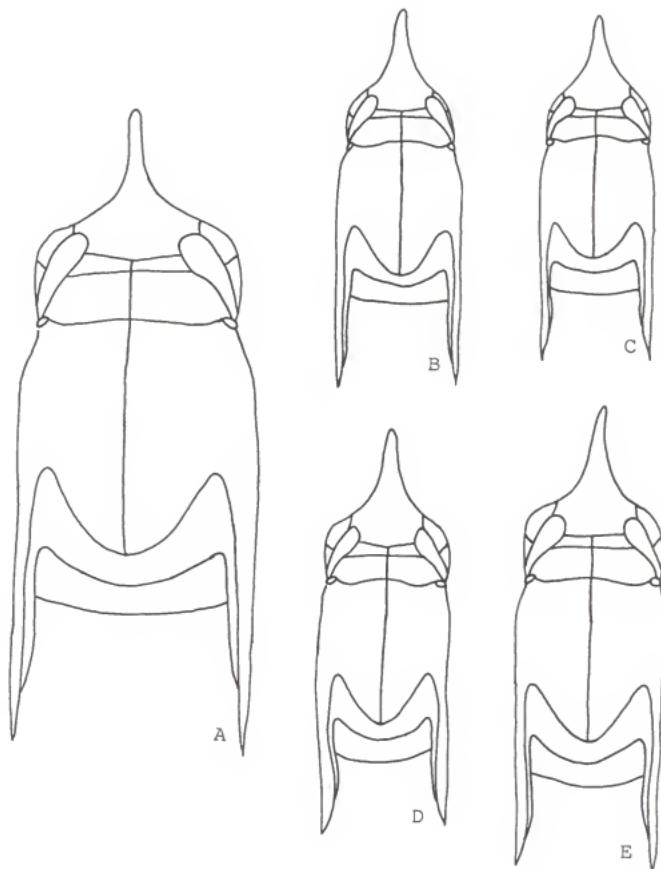


Figure 76. Dorsal view of anterior pupa of *Calpodes ethlius* (A), *Panoquina panoquin* (B), *P. panoquinoides* (C), *P. ocola* (D), and *P. sylvicola* (E). All drawings are enlarged six times.

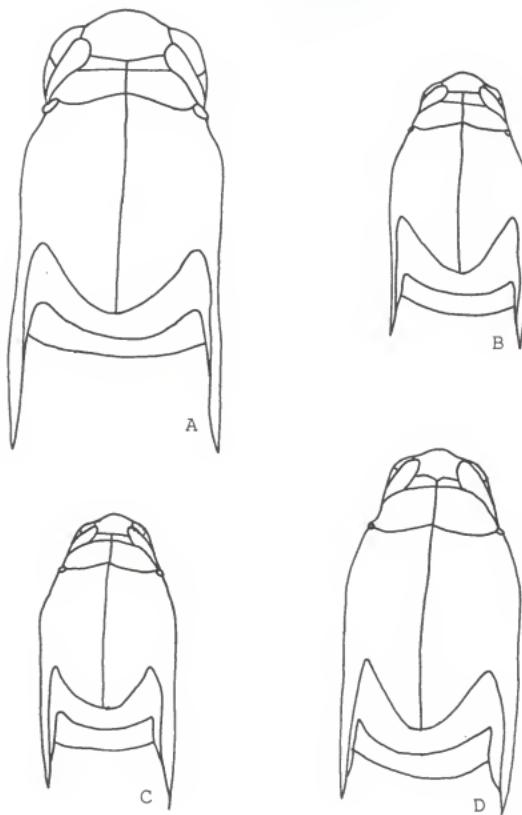


Figure 77. Dorsal view of anterior pupa of *Nyctelius nyctelius* (A), *Megathymus coloradensis* (B), *M. cofaqui* (C), and *M. ursus* (D). Drawing A is enlarged six times; B-D are enlarged three times.

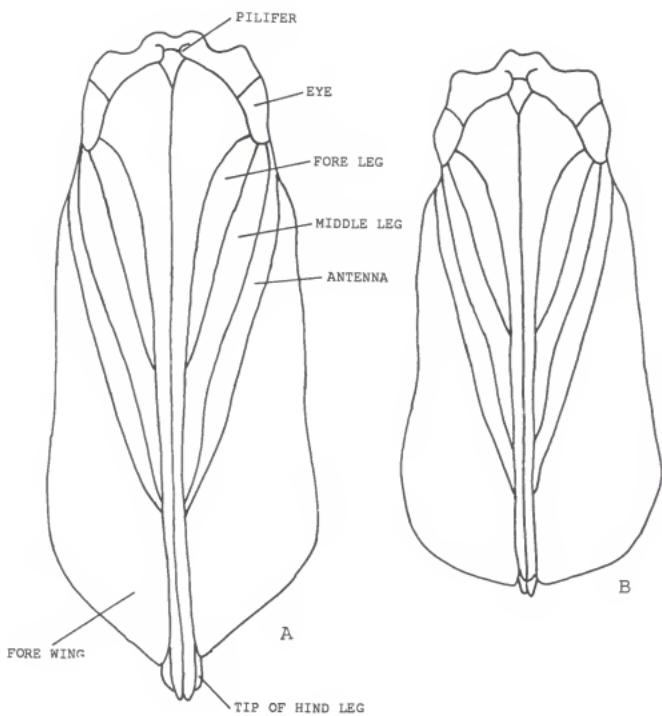


Figure 78. Ventral view of anterior pupa of *Phocides pigmalion* (A) and *P. palemon* (B). All drawings are enlarged six times.

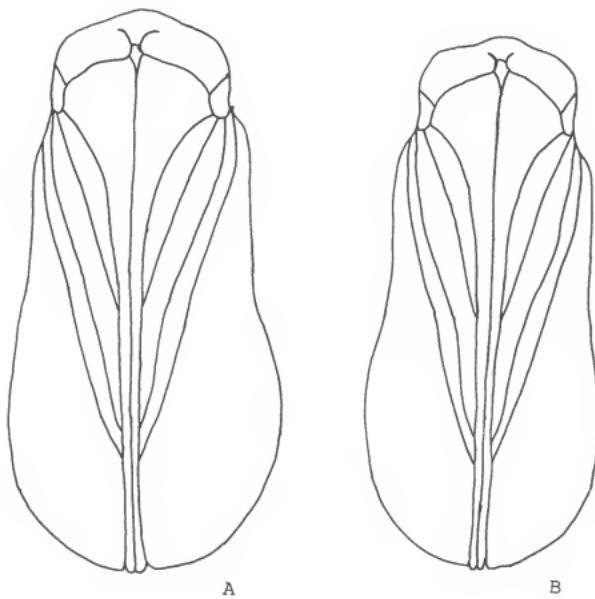


Figure 79. Ventral view of anterior pupa of *Epargyreus zestos* (A) and *E. clarus* (B). All drawings are enlarged six times.

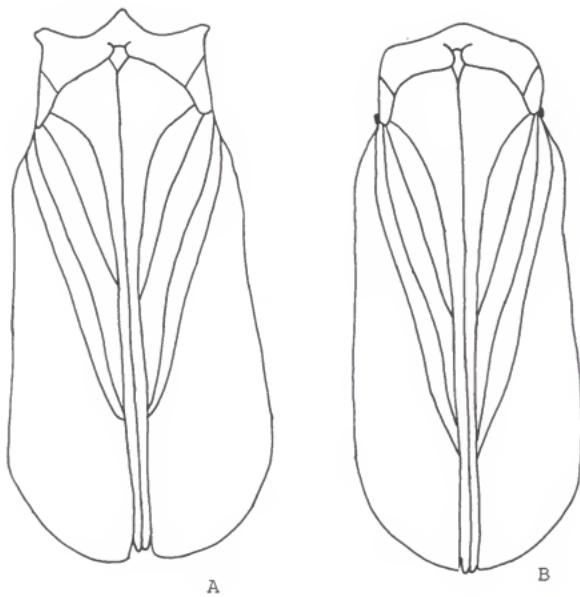


Figure 80. Ventral view of anterior pupa of *Polygonus leo* (A) and *Chiooides catillus* (B). All drawings are enlarged six times.

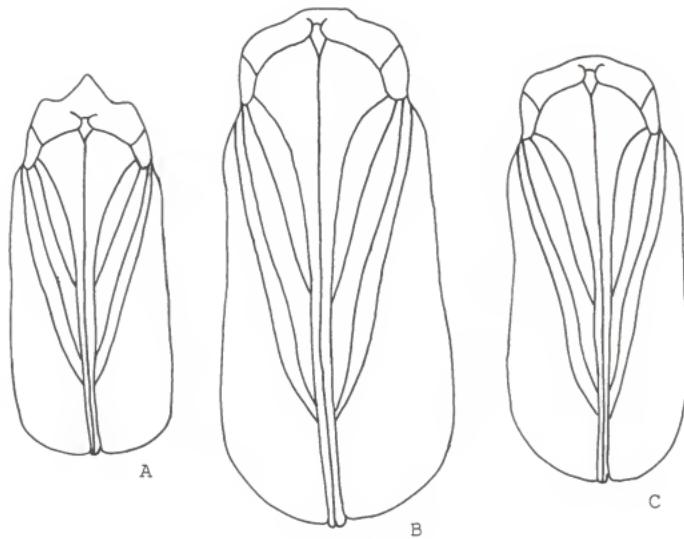


Figure 81. Ventral view of anterior pupa of *Polythrix mexicana* (A), *Codatractus alcaeus* (B), and *C. arizonensis* (C). All drawings are enlarged six times.

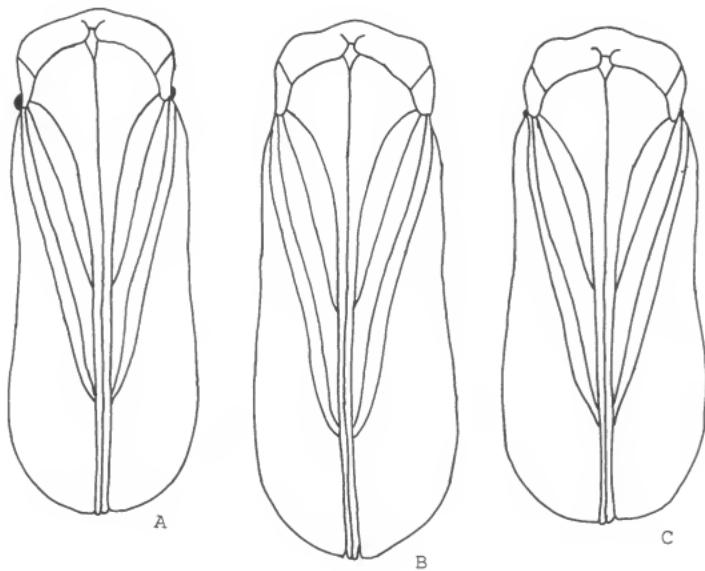


Figure 82. Ventral view of anterior pupa of *Urbanus proteus* (A), *U. esmeraldus* (B), and *U. dorantes* (C). All drawings are enlarged six times.

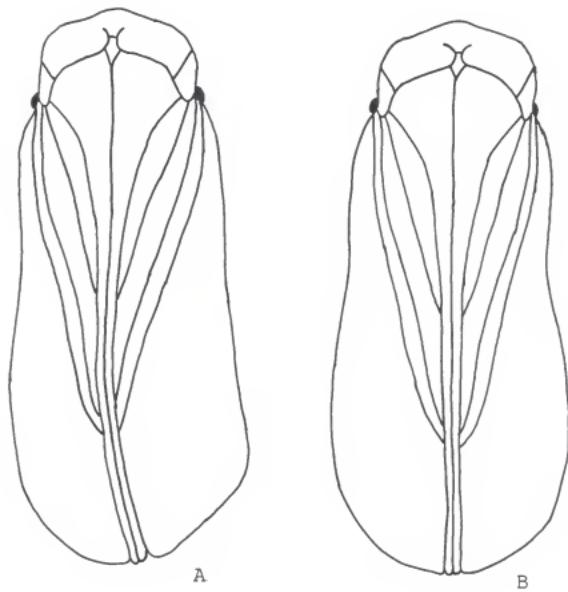


Figure 83. Ventral view of anterior pupa of *Urbanus teleus* (A) and *U. procne* (B). All drawings are enlarged six times.

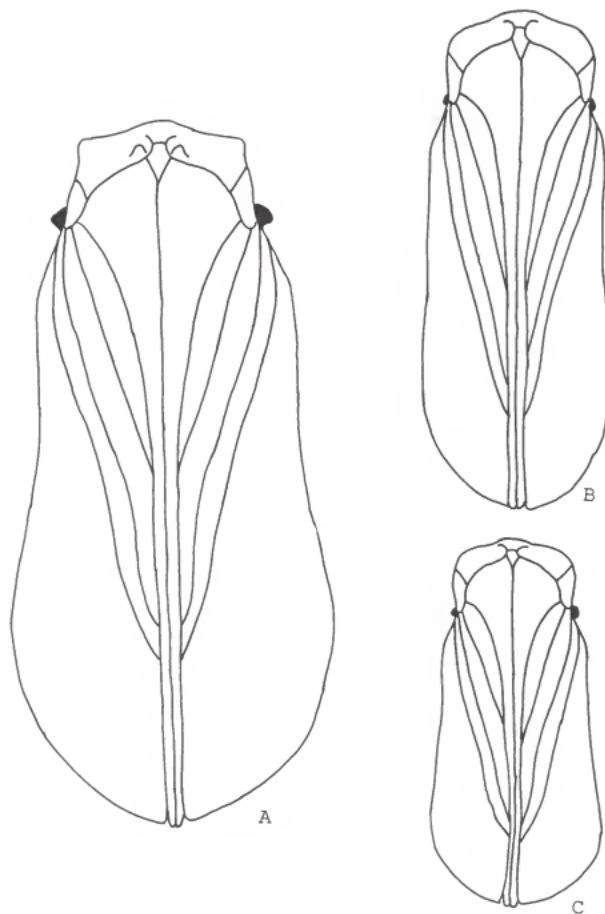


Figure 84. Ventral view of anterior pupa of *Astraptes fulgerator* (A), *A. gilberti* (B), and *Autochton cellus* (C). All drawings are enlarged six times.

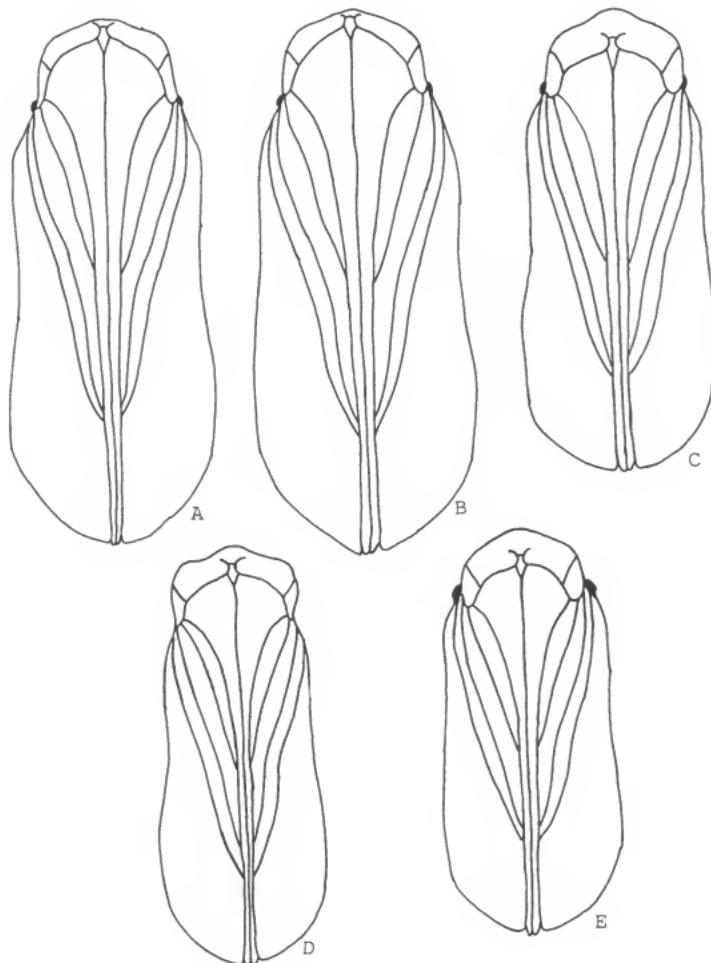


Figure 85. Ventral view of anterior pupa of *Thorybes bathyllus* (A), *T. pylades* (B), *T. confusis* (C), *Cabares potrillo* (D), and *Cogia outis* (E). All drawings are enlarged six times.

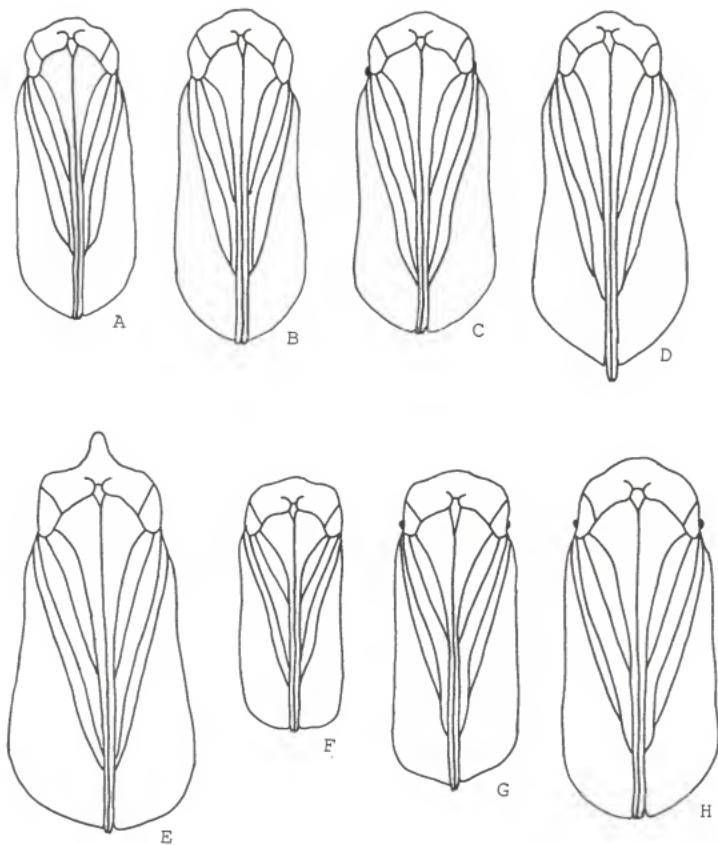


Figure 86. Ventral view of anterior pupa of *Staphylus ceos* (A), *S. hayhurstii* (B), *Carrhenes canescens* (C), *Systasea pulverulenta* (D), *Achlyodes thraso* (E), *Chiomara asychis* (F), *Gesta gesta* (G), and *Ephyriades brunneus* (H). All drawings are enlarged six times.

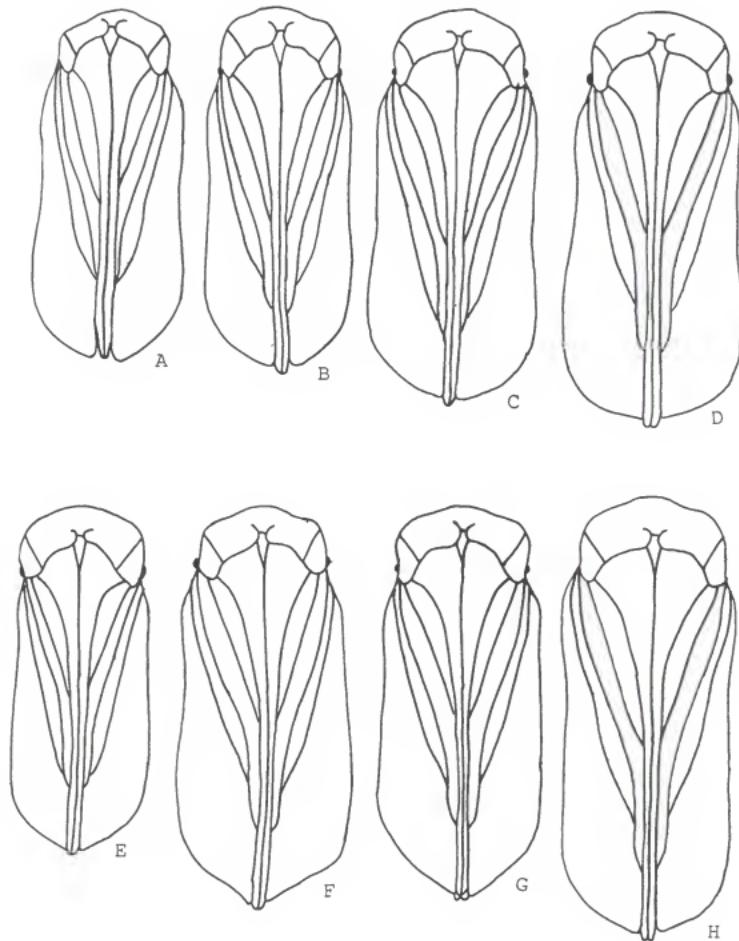


Figure 87. Ventral view of anterior pupa of *Erynnis icelus* (A), *E. brizo* (B), *E. juvenalis* (C), *E. horatius* (D), *E. tristis* (E), *E. martialis* (F), *E. zarucco* (G), and *E. funeralis* (H). All drawings are enlarged six times.

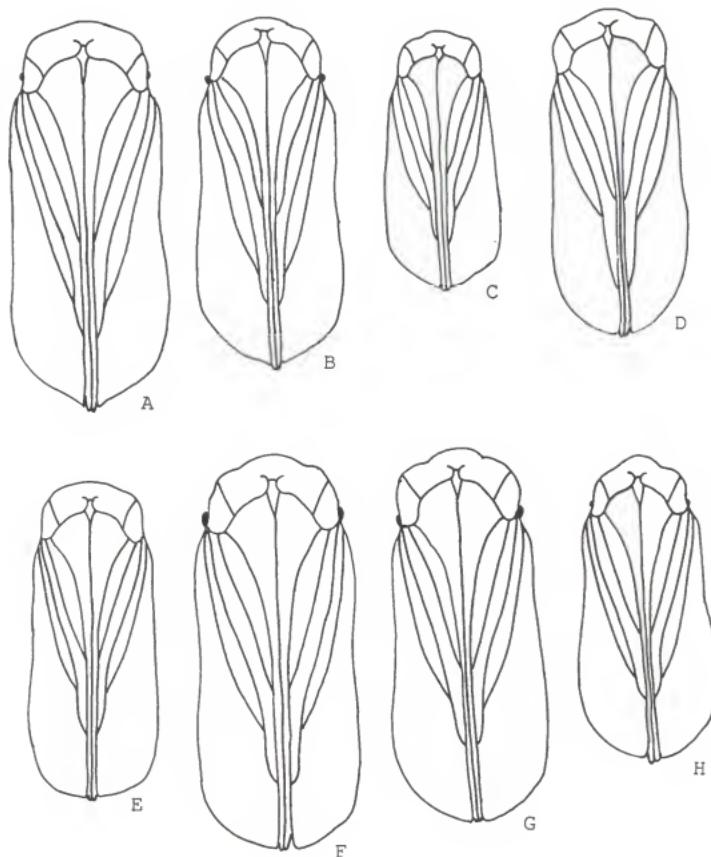


Figure 88. Ventral view of anterior pupa of *Erynnis baptisiae* (A), *E. persius* (B), *Pyrgus scriptura* (C), *P. communis* (D), *P. oileus* (E), *Heliopetes ericetorum* (F), *H. lavianus* (G), and *Celotes nessus* (H). All drawings are enlarged six times.

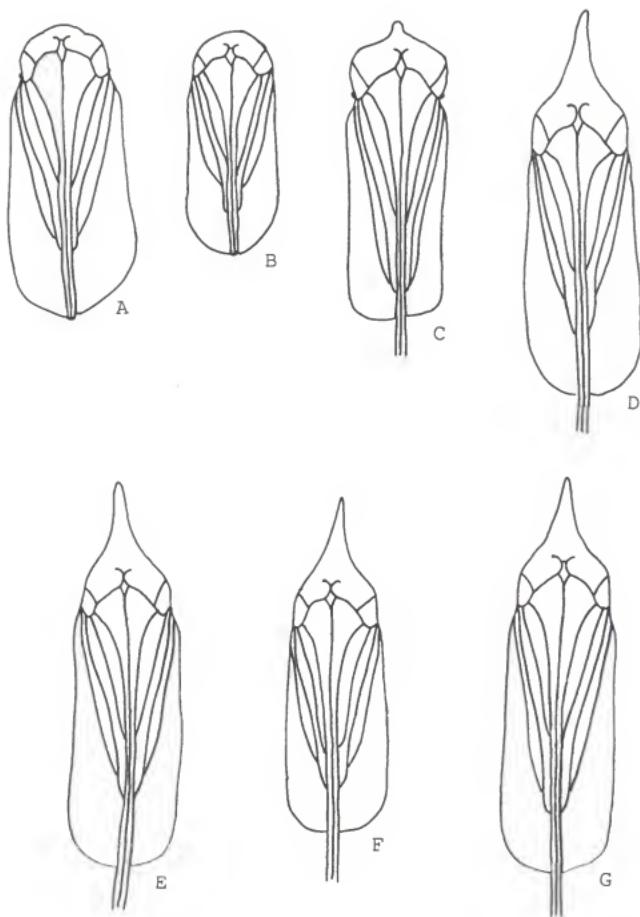


Figure 89. Ventral view of anterior pupa of *Pholisora catullus* (A), *P. alpheus* (B), *Synapte malitiosa* (C), *Nastralherminier* (D), *N. julia* (E), *N. neamathla* (F), and *Cymaenes tripunctus* (G). All drawings are enlarged six times.

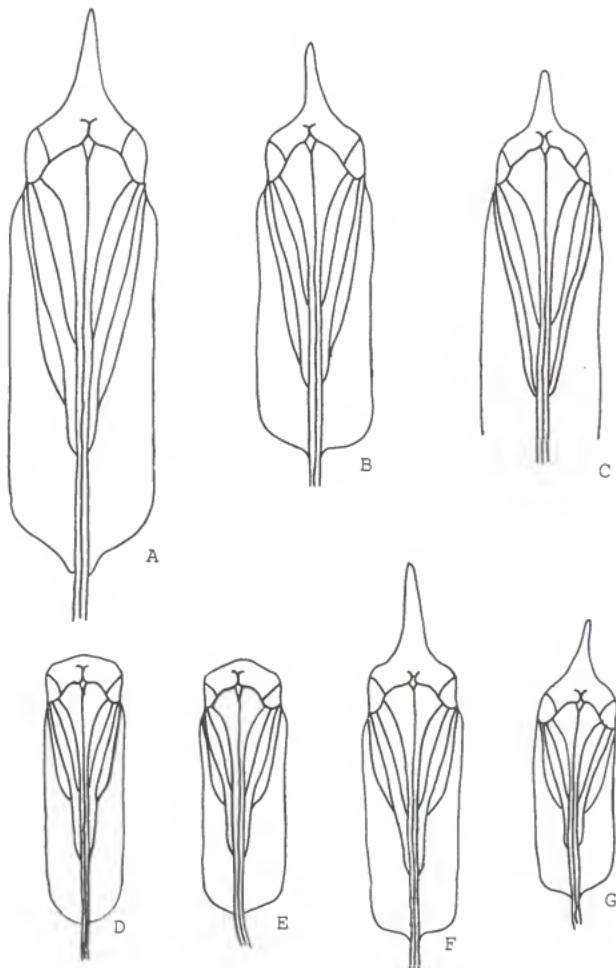


Figure 90. Ventral view of anterior pupa of *Lerema accius* (A), *L. liris* (B), *Perichares philetas* (C), *Ancyloxypha numitor* (D), *A. arene* (E), *Copaeodes aurantiacus* (F), and *C. minimus* (G). Drawings A-B and D-G are enlarged six times; C is enlarged three times.

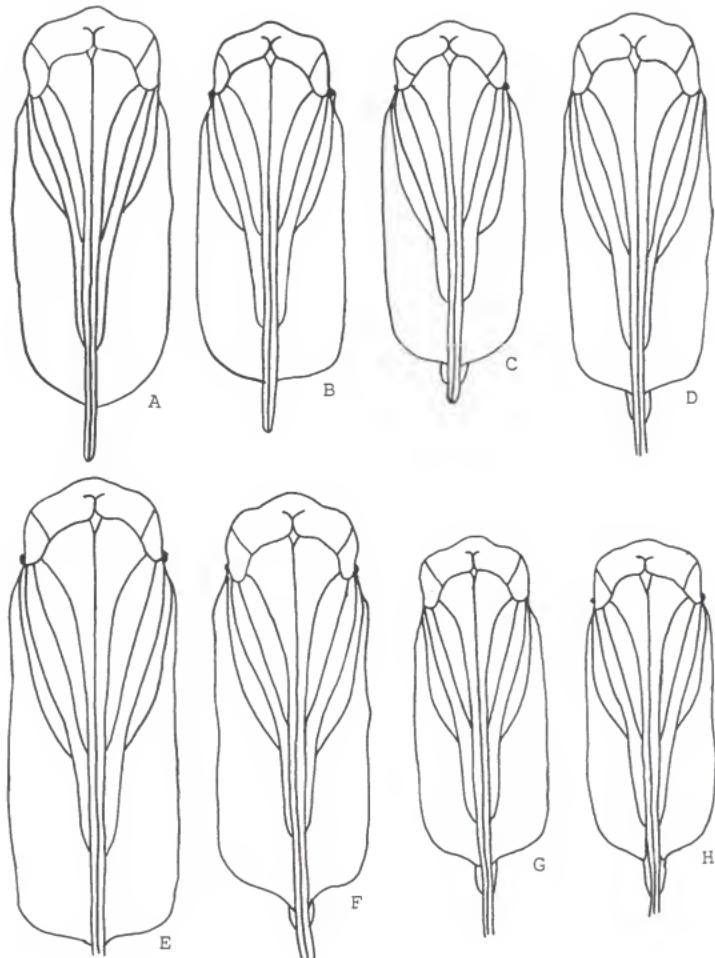


Figure 91. Ventral view of anterior pupa of *Hylephila phyleus* (A), *Yvretta carus* (B), *Pseudocopaeodes eunus* (C), *Hesperia uncas* (D), *H. comma* (E), *H. attalus* (F), *Polites coras* (G), and *P. sabuleti* (H). All drawings are enlarged six times.

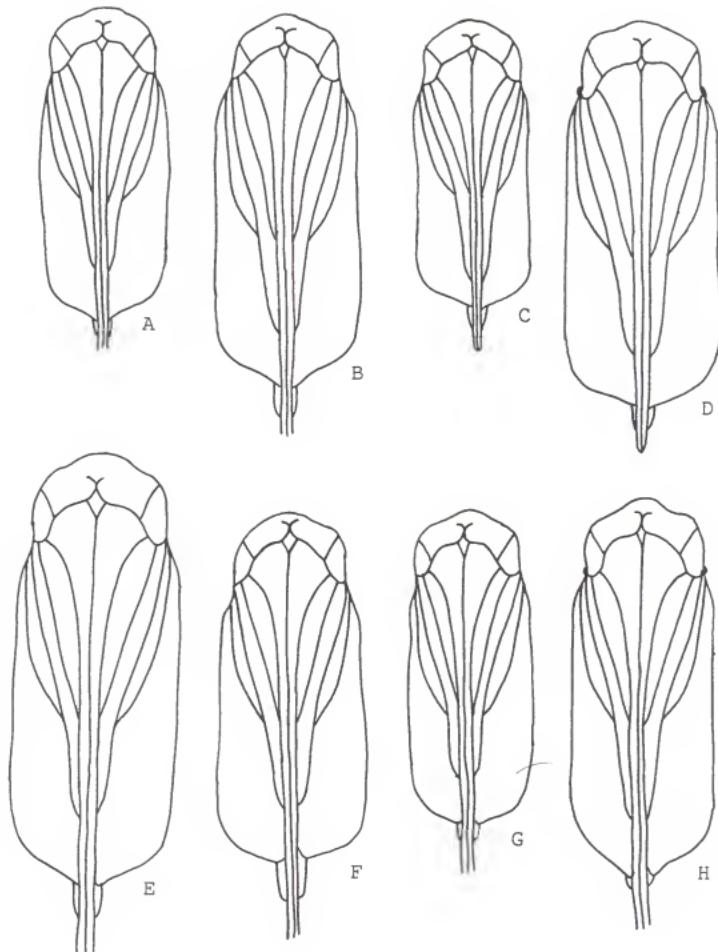


Figure 92. Ventral view of anterior pupa of *Polites mardon* (A), *P. draco* (B), *P. baracoa* (C), *P. themistocles* (D), *P. origenes* (E), *P. mystic* (F), *P. sonora* (G), and *P. vibex* (H). All drawings are enlarged six times.

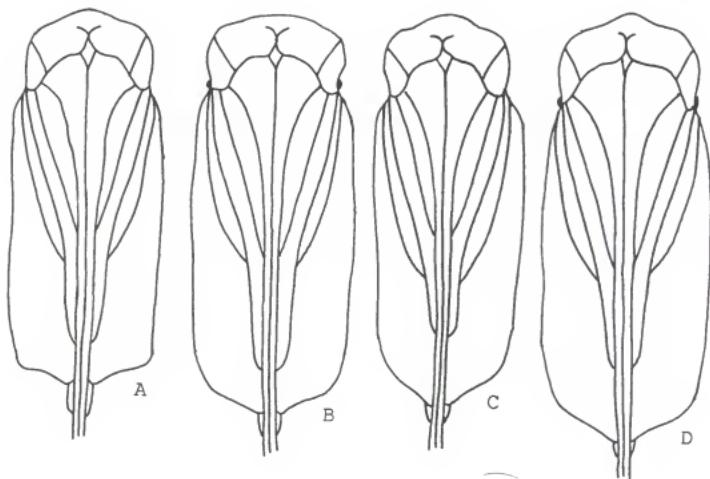


Figure 93. Ventral view of anterior pupa of *Wallengrenia otho* (A), *W. egeremet* (B), *Pompeius verna* (C), and *Atalopedes campestris* (D). All drawings are enlarged six times.

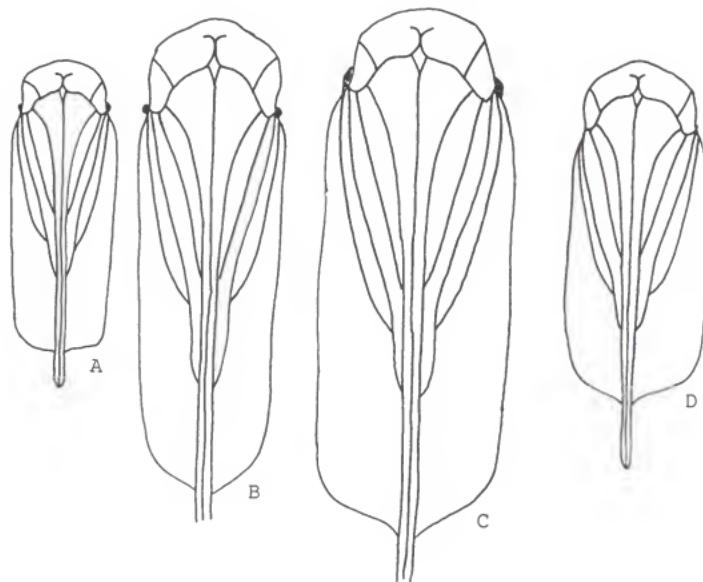


Figure 94. Ventral view of anterior pupa of *Atrytone arogos* (A), *A. delaware* (B), *Problema byssus* (C), and *Ochloides sylvanoides* (D). All drawings are enlarged six times.

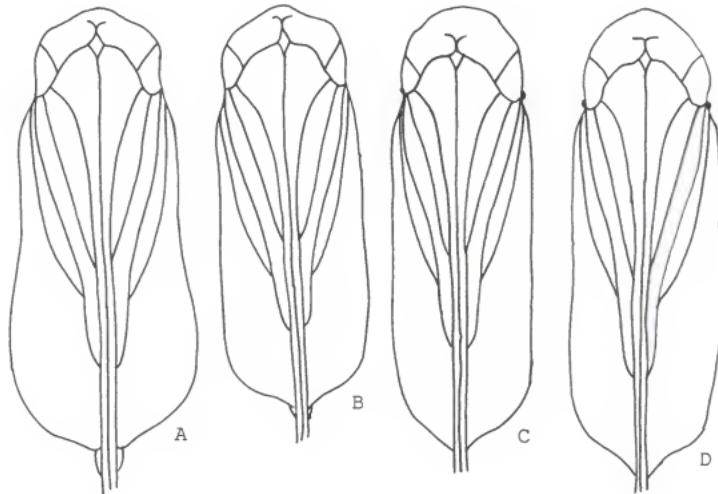


Figure 95. Ventral view of anterior pupa of *Poanes hobomok* (A), *P. taxiles* (B), *P. aaroni* (C), and *P. yehl* (D). All drawings are enlarged six times.

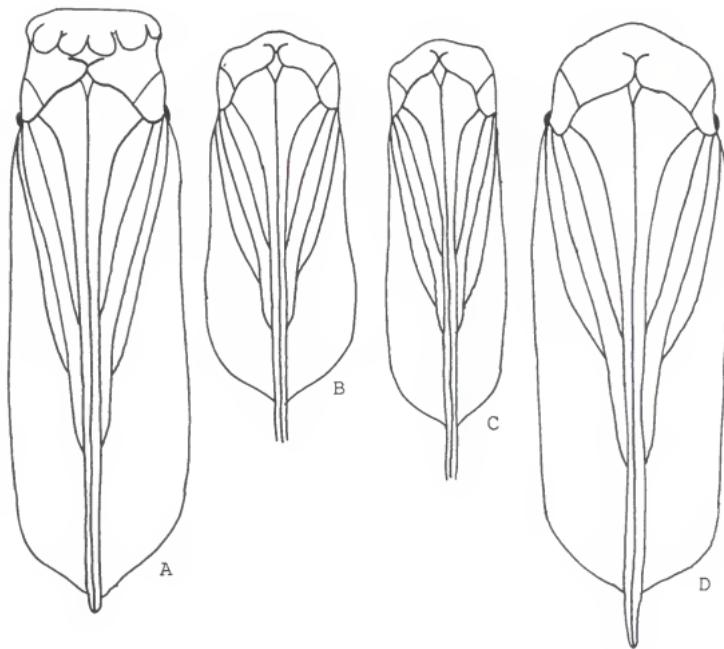


Figure 96. Ventral view of anterior pupa of *Poanes viator* (A), *Paratrytone melane* (B), *Choranthus haitensis* (C), and *Euphyes arpa* (D). All drawings are enlarged six times.

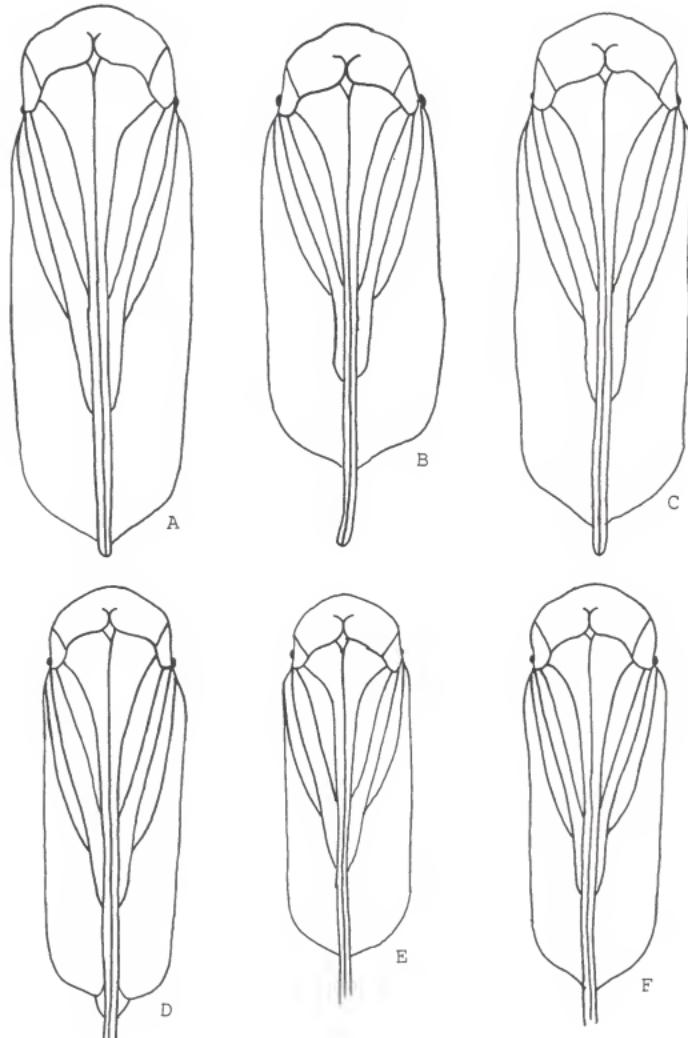


Figure 97. Ventral view of anterior pupa of *Euphyes pilatka* (A), *E. alabamae* (B), *E. dukesi* (C), *E. berryi* (D), *E. bimacula* (E), and *E. ruricola* (F). All drawings are enlarged six times.

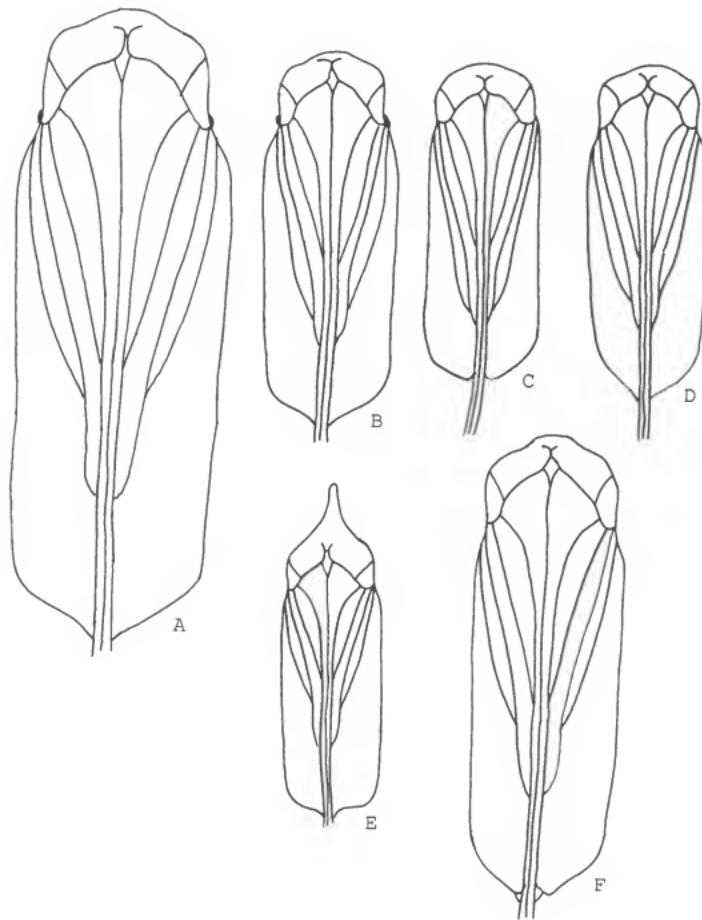


Figure 98. Ventral view of anterior pupa of *Asbolis capucinus* (A), *Atrytonopsis loammi* (B), *Amblyscirtes aesculapias* (C), *A. celia* (D), *Lerodea eufala* (E), and *Oligoria maculata* (F). All drawings are enlarged six times.

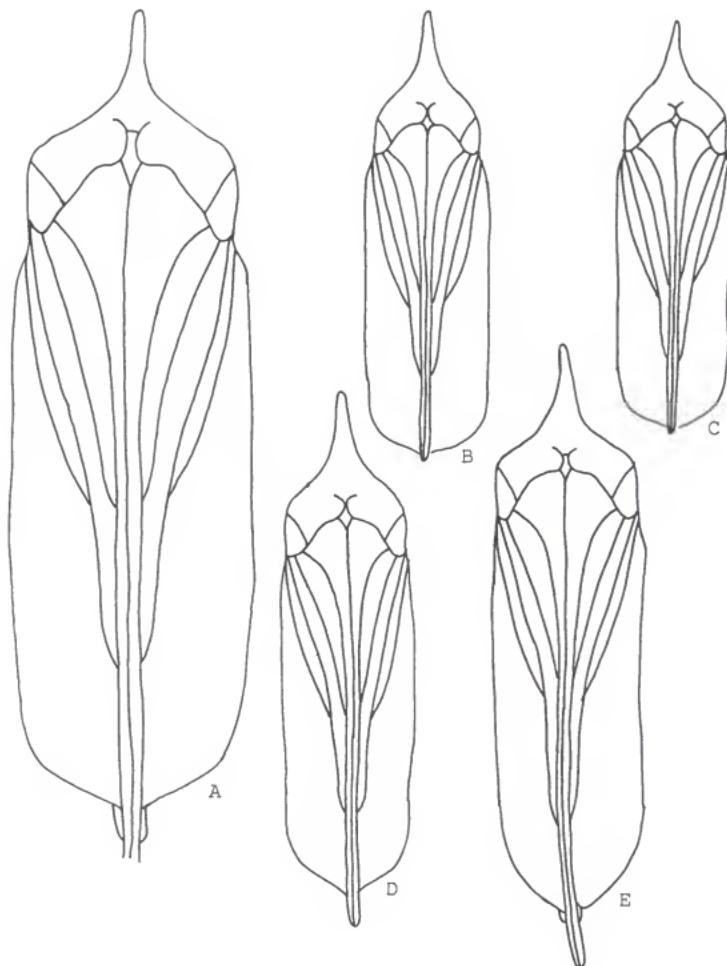


Figure 99. Ventral view of anterior pupa of *Calpodes ethlius* (A), *Panoquina panoquin* (B), *P. panoquinoides* (C), *P. ocola* (D), and *P. sylvicola* (E). All drawings are enlarged six times.

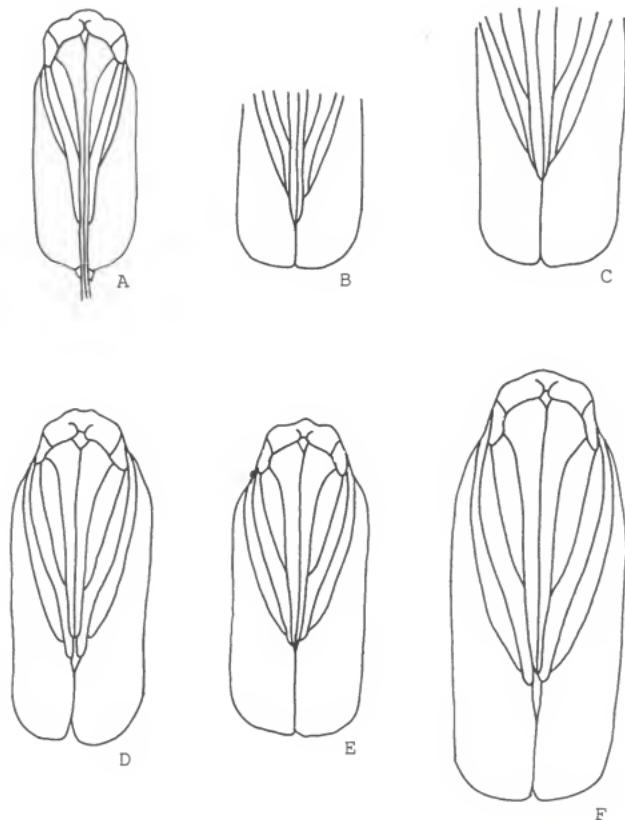


Figure 100. Ventral view of anterior pupa of *Nyctelius nyctelius* (A), *Agathymus valverdiensis* (B), *Megathymus yuccae* (C), *M. coloradensis* (D), *M. cofaqui* (E), and *M. ursus* (F). All drawings are enlarged three times.

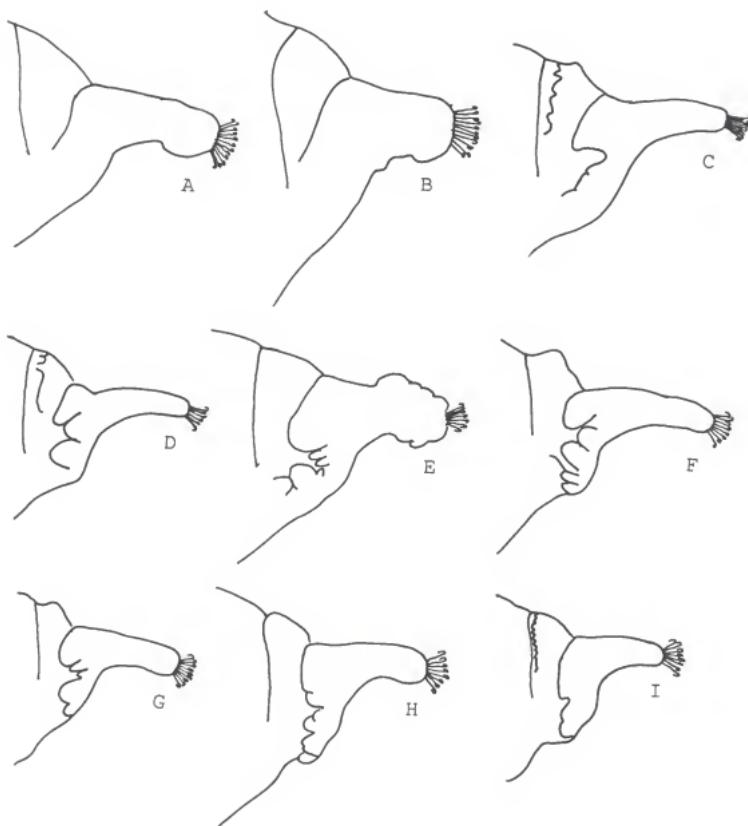


Figure 101. Lateral view of the cremaster of *Phocides pigmalion* (A), *P. palemon* (B), *Epargyreus zestos* (C), *E. clarus* (D), *Polygonus leo* (E), *Chioctides catillus* (F), *Polythrix mexicana* (G), *Codatractus alcaeus* (H), and *C. arizonensis* (I). All drawings are enlarged 12 times.

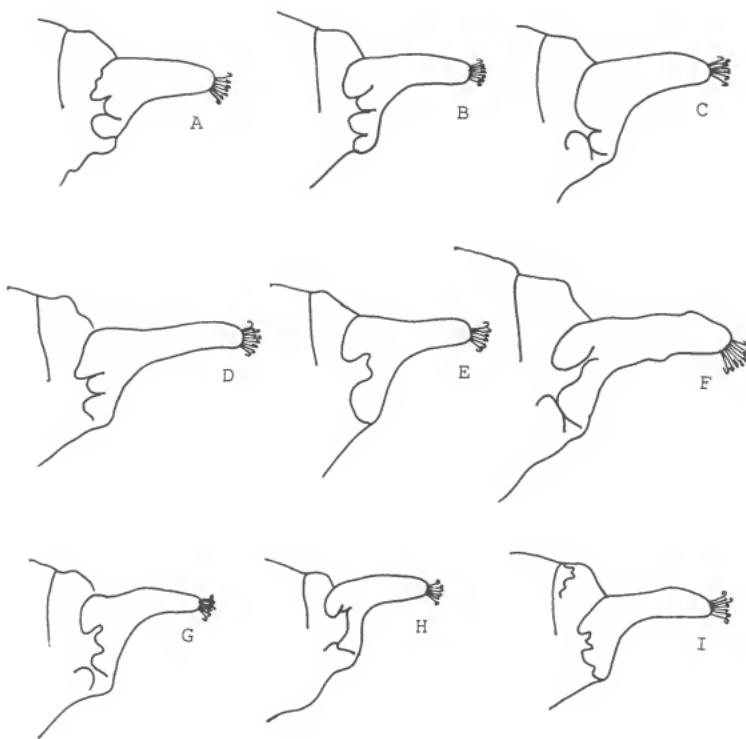


Figure 102. Lateral view of the cremaster of *Urbanus proteus* (A), *U. esmeraldus* (B), *U. dorantes* (C), *U. teleus* (D), *U. procne* (E), *Astraptes fulgerator* (F), *A. gilberti* (G), *Autochton cellus* (H), and *Achalarus lyciades* (I). All drawings are enlarged 12 times.

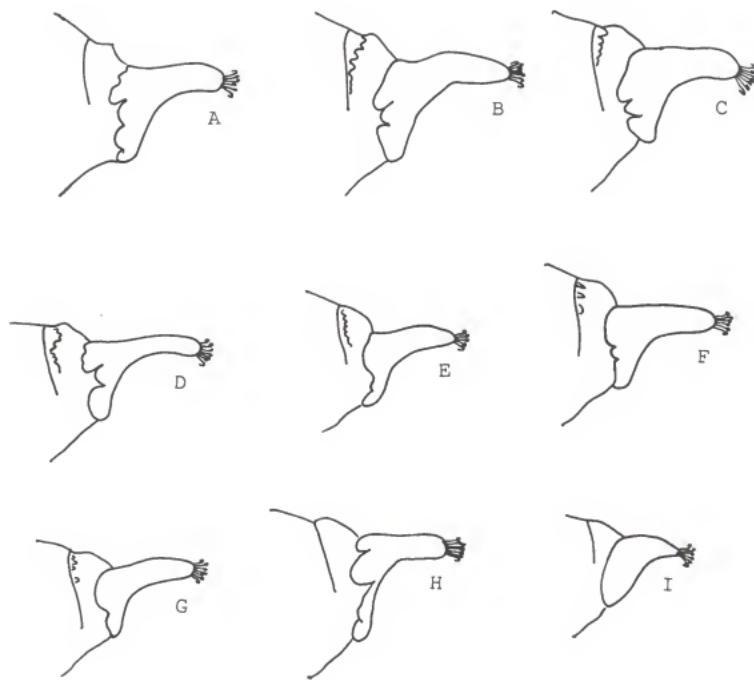


Figure 103. Lateral view of the cremaster of *Thorybes bathyllus* (A), *T. pylades* (B), *T. confusis* (C), *Cabares potrillo* (D), *Cogia hippalus* (E), *C. outis* (F), *C. caicus* (G), *Nisoniades rubescens* (H), and *Staphylus ceos* (I). All drawings are enlarged 12 times.

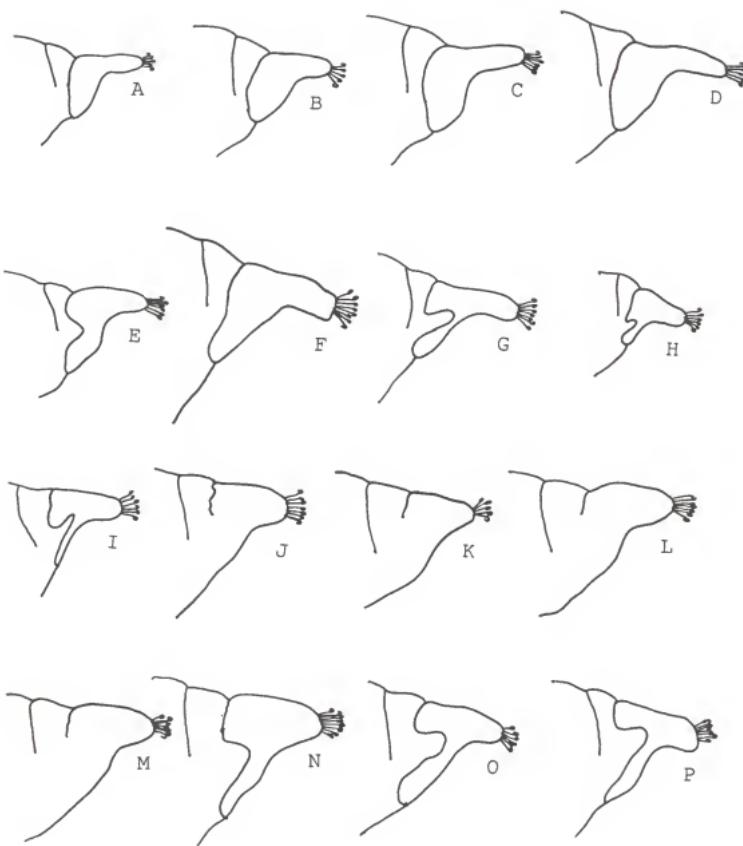


Figure 104. Lateral view of the cremaster of *Staphylus mazans* (A), *S. hayhurstii* (B), *Carrenhes canescens* (C), *Xenophanhes trixus* (D), *Systasea pulverulenta* (E), *Achlyodes thraso* (F), *Timochares ruptifasciatus* (G), *Chiomara asychis* (H), *Gesta gesta* (I), *Ephyriades brunneus* (J), *Erynnis icelus* (K), *E. brizo* (L), *E. juvenalis* (M), *E. horatius* (N), *E. tristis* (O), and *E. martialis* (P). All drawings are enlarged 12 times.

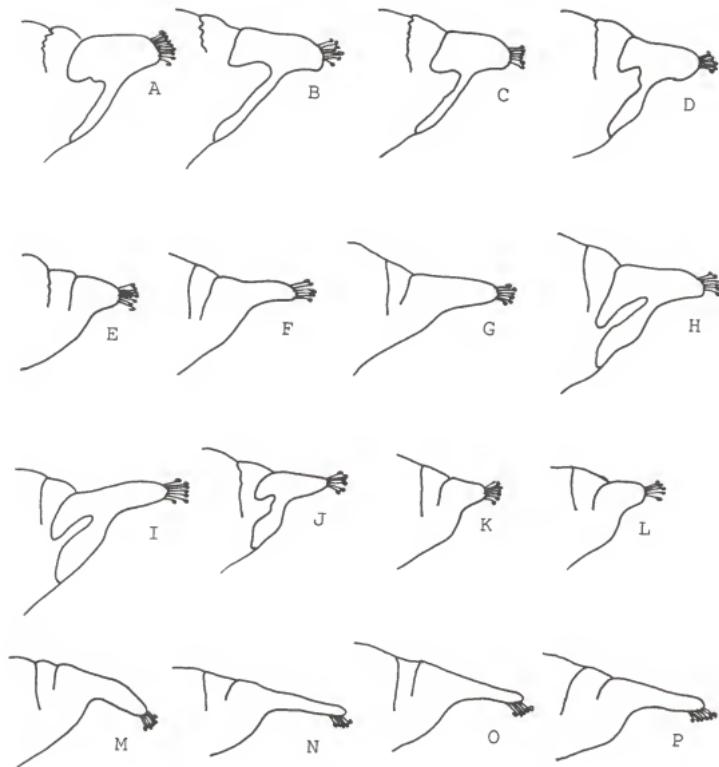


Figure 105. Lateral view of the cremaster of *Erynnis zarucco* (A), *E. funeralis* (B), *E. baptisiae* (C), *E. persius* (D), *Pyrgus scriptura* (E), *P. communis* (F), *P. oileus* (G), *Heliopetes ericetorum* (H), *H. lavianus* (I), *Celotes nessus* (J), *Pholisora catullus* (K), *P. alpheus* (L), *Synapte malitiosa* (M), *Nastra lherminier* (N), *N. julia* (O), and *N. neamathela* (P). All drawings are enlarged 12 times.

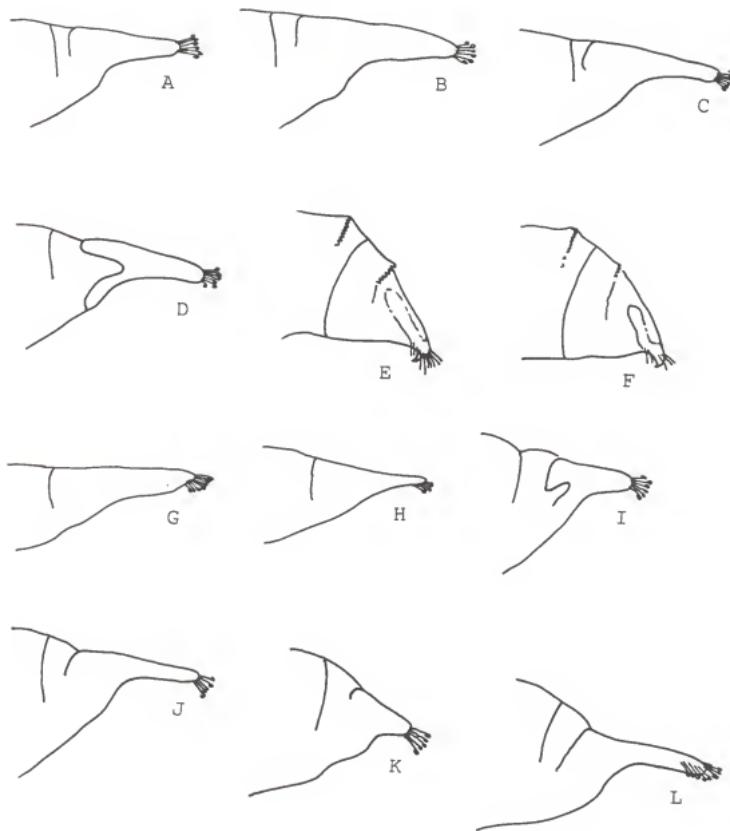


Figure 106. Lateral view of the cremaster of *Cymaenes tripunctus* (A), *Lerema accius* (B), *L. liris* (C), *Perichares philetetes* (D), *Ancyloxypha numitor* (E), *A. arene* (F), *Copaeodes aurantiacus* (G), *C. minimus* (H), *Hylephila phyleus* (I), *Yvretta carus* (J), *Pseudocopaeodes eunus* (K), and *Hesperia uncas* (L). Drawings A-C and E-L are enlarged 12 times; D is enlarged 6 times.

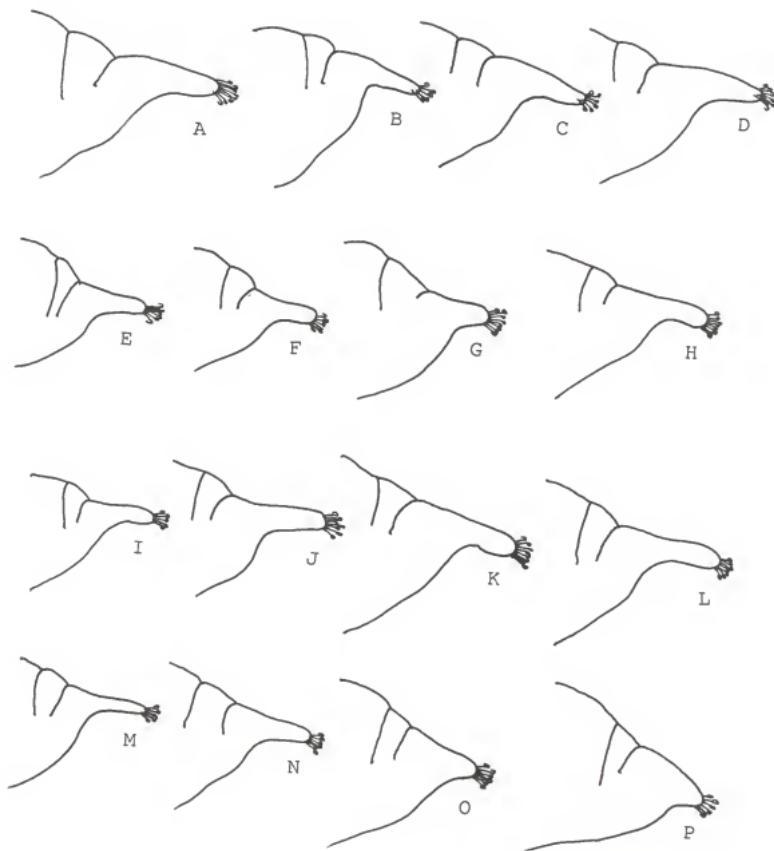


Figure 107. Lateral view of the cremaster of *Hesperia comma* (A), *H. woodgatei* (B), *H. viridis* (C), *H. attalus* (D), *Polites coras* (E), *P. sabuleti* (F), *P. mardon* (G), *P. draco* (H), *P. baracoa* (I), *P. themistocles* (J), *P. origenes* (K), *P. mystic* (L), *P. sonora* (M), *P. vibex* (N), *Wallengrenia otho* (O), and *W. egeremet* (P). All drawings are enlarged 12 times.

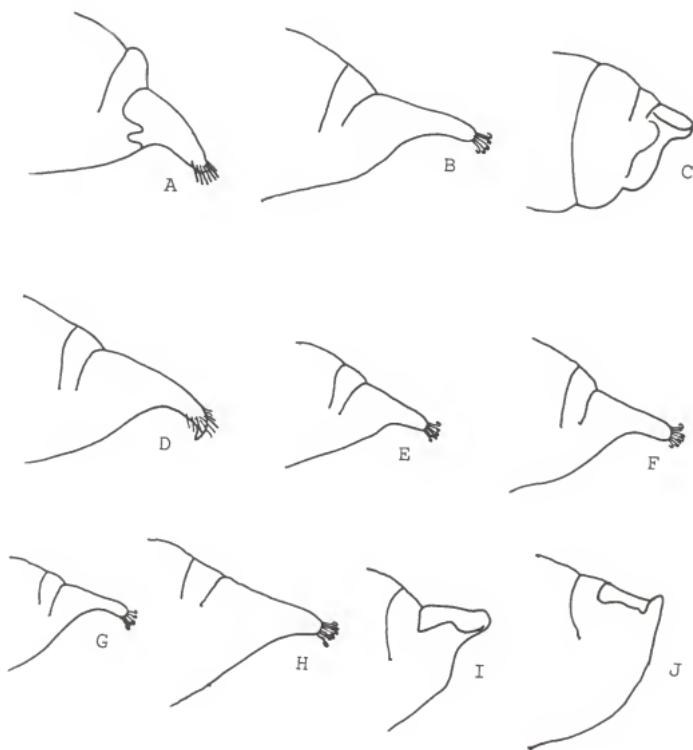


Figure 108. Lateral view of the cremaster of *Pompeius verna* (A), *Atalopedes campestris* (B), *Atrytone arogos* (C), *A. delaware* (D), *Prolema byssus* (E), *Ochlodes sylvanoides* (F), *Poanes hobomok* (G), *P. taxiles* (H), *P. aaroni* (I), and *P. yehl* (J). All drawings are enlarged 12 times.

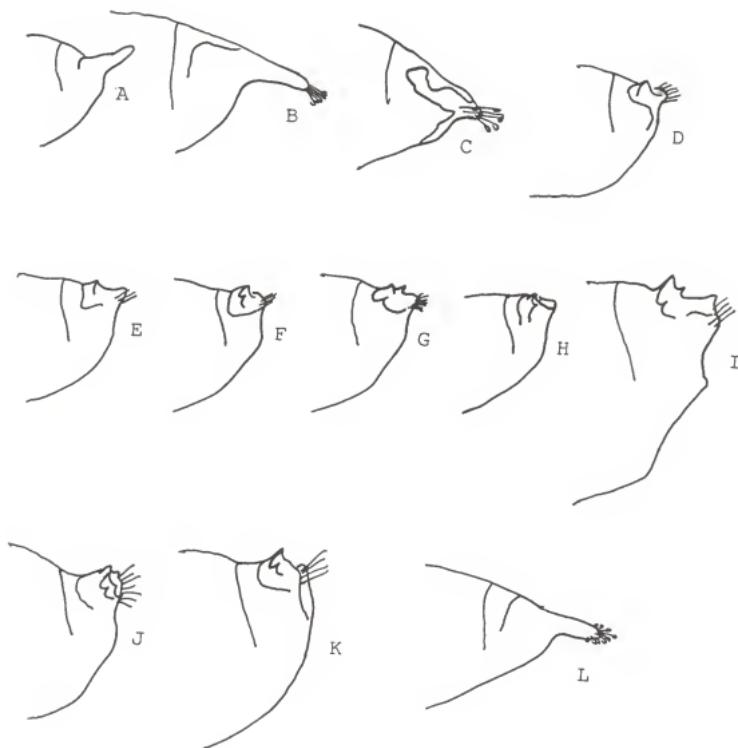


Figure 109. Lateral view of the cremaster of *Poanidae* (*Poanes viator* (A), *Paratrytone melane* (B), *Choranthus haitensis* (C), *Euphyes arpa* (D), *E. pilatka* (E), *E. alabamae* (F), *E. dukesi* (G), *E. berryi* (H), *E. macguirei* (I), *E. bimacula* (J), *E. ruricola* (K), and *Asbolis capucinus* (L)). Drawings A-C and H-K are enlarged 12 times; D-G and L are enlarged 6 times.

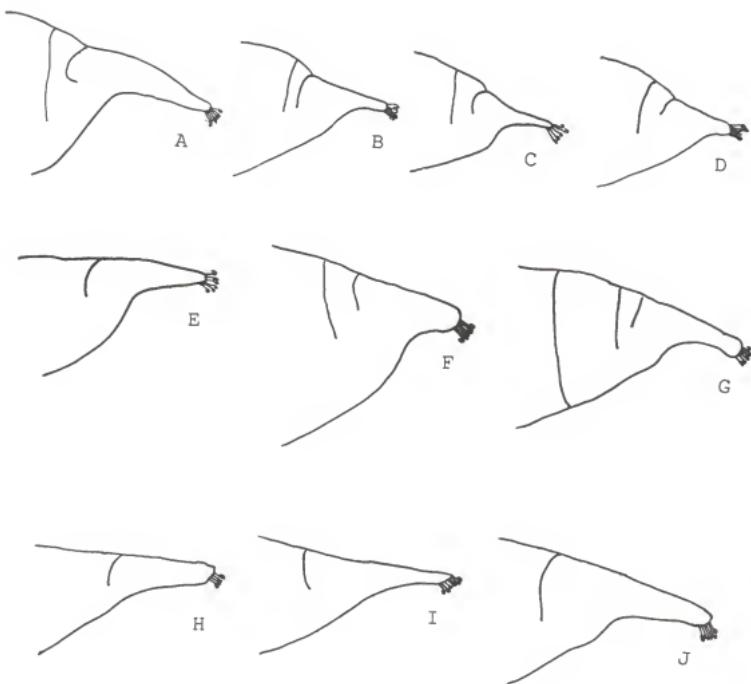


Figure 110. Lateral view of the cremaster of *Atrytonopsis loammi* (A), *Amblyscirtes aesculapias* (B), *A. vialis* (C), *A. celia* (D), *Lerodea eupala* (E), *Oligoria maculata* (F), *Calpodes ethlius* (G), *Panoquina panoquin* (H), *P. panoquinoides* (I), and *P. ocola* (J). Drawings A-F and H-J are enlarged 12 times; G is enlarged 6 times.

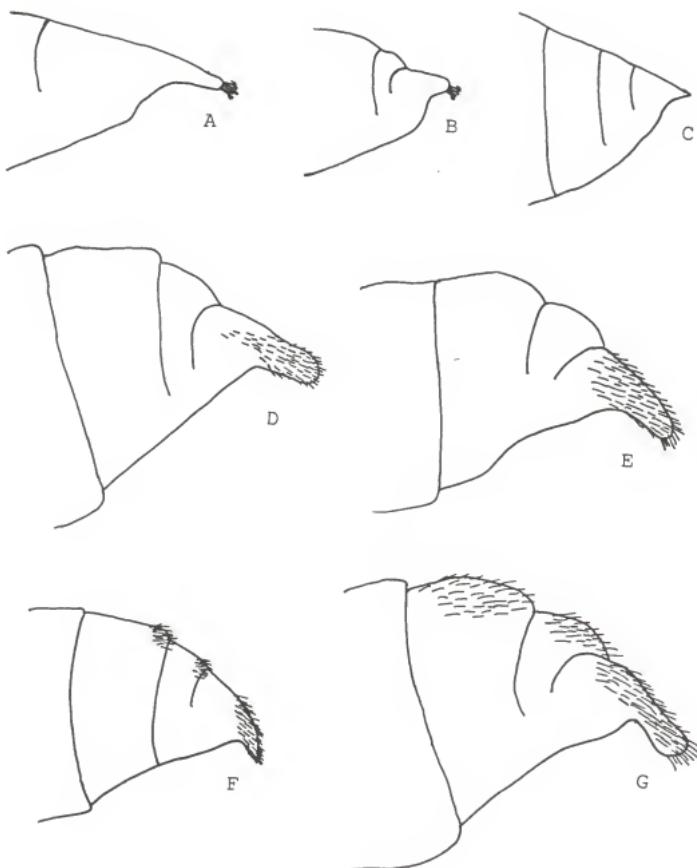


Figure 111. Lateral view of the cremaster of *Panoquina sylvicola* (A), *Nyctelius nyctelius* (B), *Agathymus valverdiensis* (C), *Megathyimus yuccae* (D), *M. coloradensis* (E), *M. cofaqui* (F), and *M. ursus* (G). Drawings A-B are enlarged 12 times; C-G are enlarged 6 times.

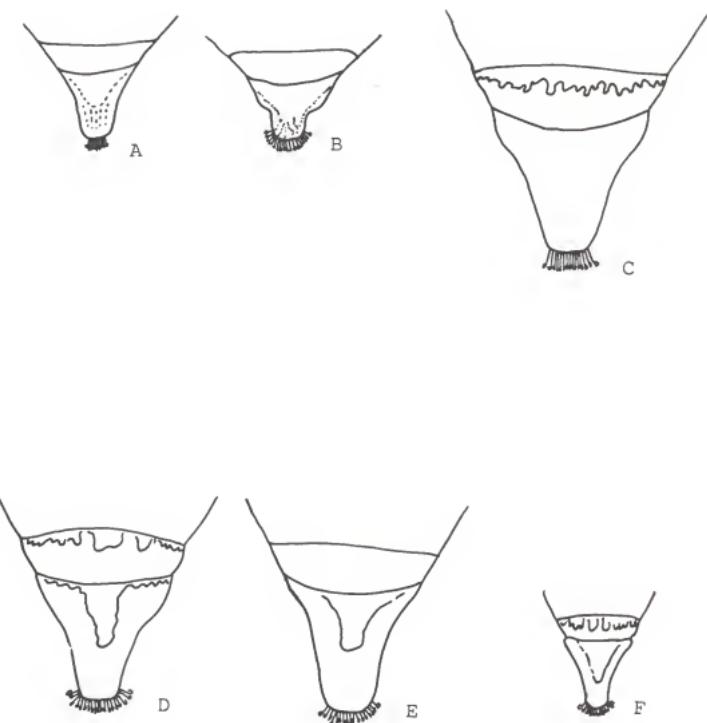


Figure 112. Dorsal view of the cremaster of *Phocides pigmalion* (A), *P. palemon* (B), *Epargyreus zestos* (C), *E. clarus* (D), *Polygonus leo* (E), and *Chioides catillus* (F). Drawings A and B are enlarged 6 times; C-F are enlarged 12 times.

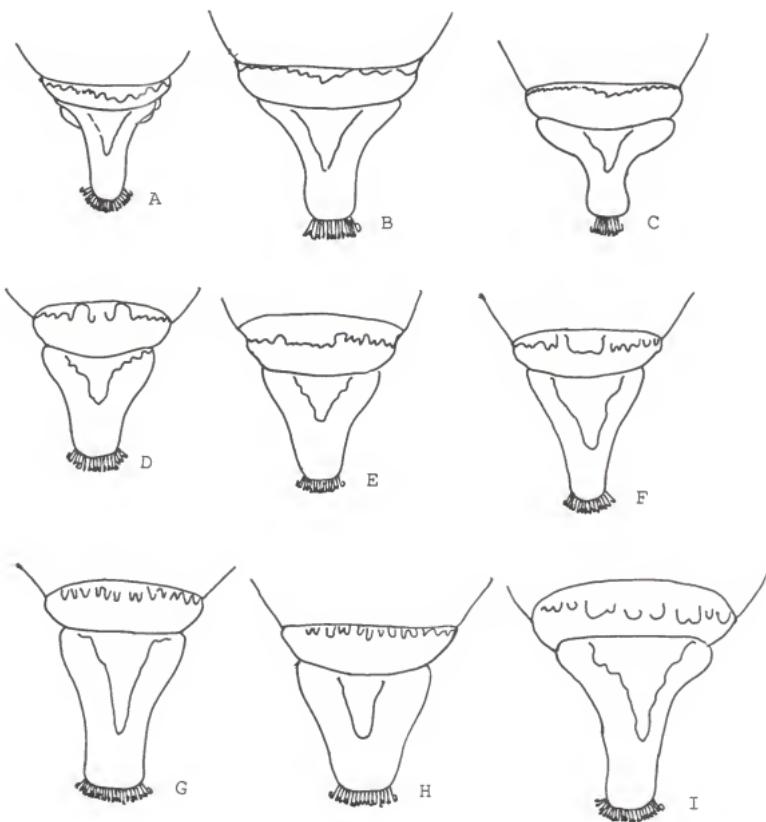


Figure 113. Dorsal view of the cremaster of *Polythrix mexicana* (A), *Codatractus alcaeus* (B), *C. arizonensis* (C), *Urbanus proteus* (D), *U. esmeraldus* (E), *U. dorantes* (F), *U. teleus* (G), *U. procne* (H), and *Astraptes fulgerator* (I). All drawings are enlarged 12 times.

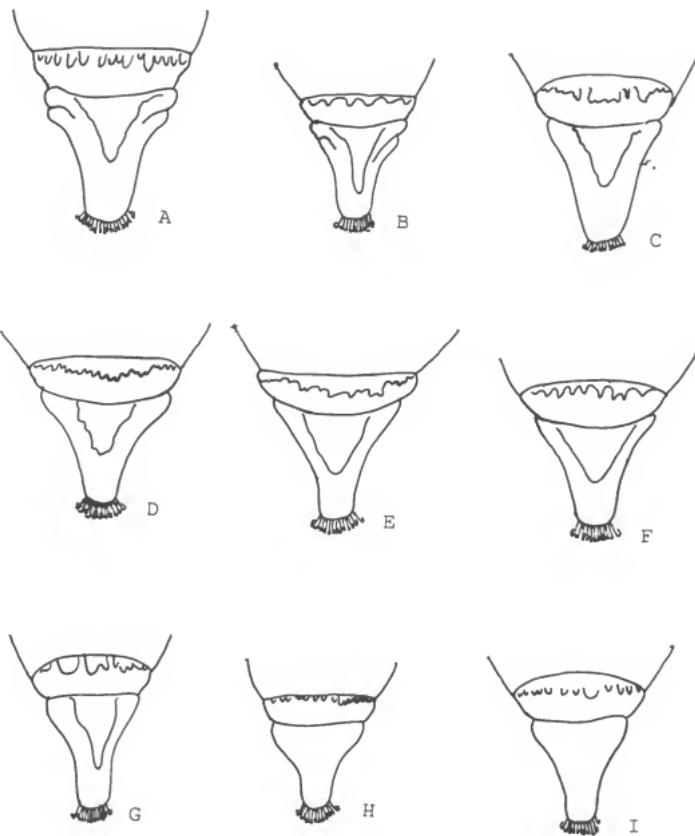


Figure 114. Dorsal view of the cremaster of *Astraptes gilberti* (A), *Autochton cellus* (B), *Achalarus lyciades* (C), *Thorybes bathyllus* (D), *T. pylades* (E), *T. confusis* (F), *Cabares potrillo* (G), *Cogia hippalus* (H), and *C. outis* (I). All drawings are enlarged 12 times.

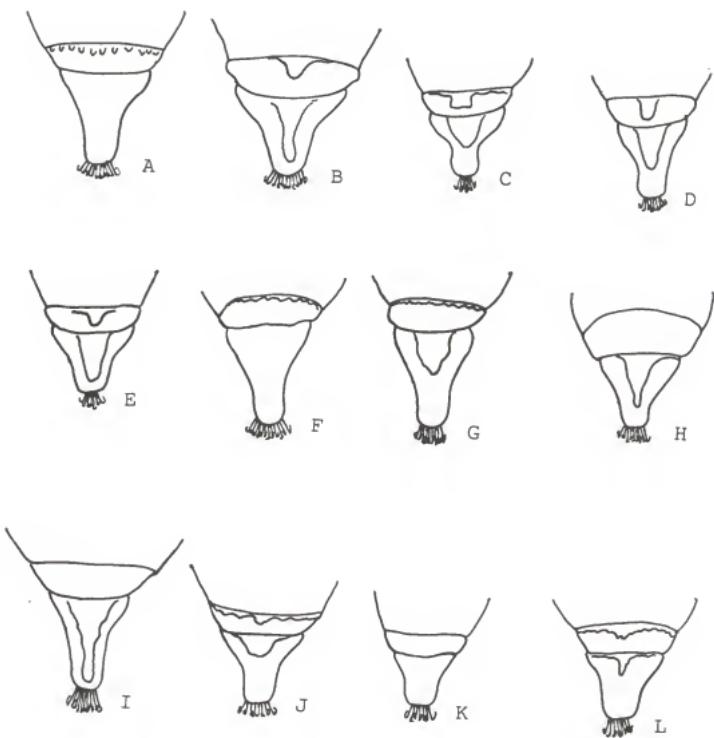


Figure 115. Dorsal view of the cremaster of *Cogia caicus* (A), *Nisoniades rubescens* (B), *Staphylus ceos* (C), *S. mazans* (D), *S. hayhurstii* (E), *Carrhenes canescens* (F), *Xenophanes trixus* (G), *Systasea pulverulenta* (H), *Achlyodes thraso* (I), *Timochares ruptifasciatus* (J), *Chiomara asychis* (K), and *Gesta gesta* (L). All drawings are enlarged 12 times.

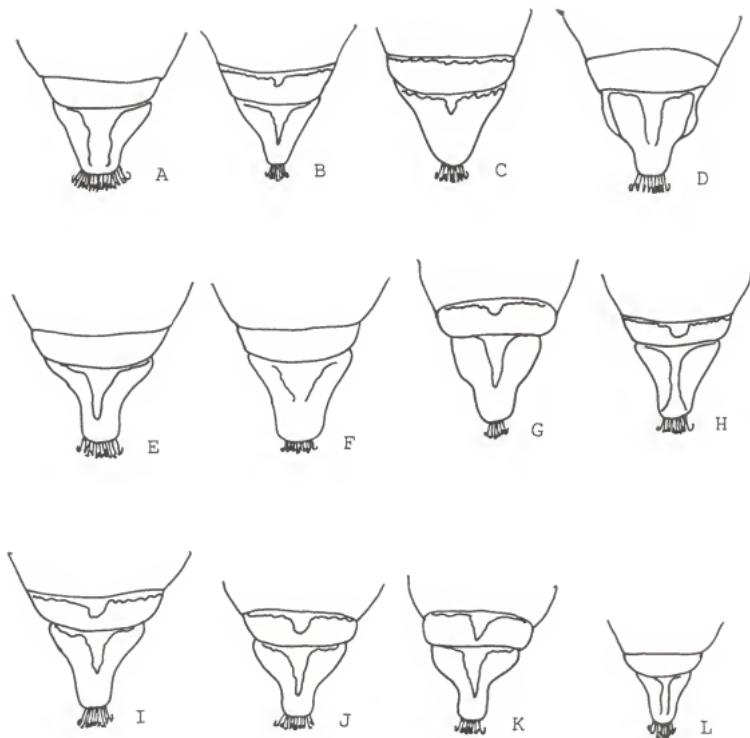


Figure 116. Dorsal view of the cremaster of *Ephyriades brunneus* (A), *Erynnis icelus* (B), *E. brizo* (C), *E. juvenalis* (D), *E. horatius* (E), *E. tristis* (F), *E. martialis* (G), *E. zarucco* (H), *E. funeralis* (I), *E. baptisiae* (J), *E. persius* (K), and *Pyrgus scriptura* (L). All drawings are enlarged 12 times.

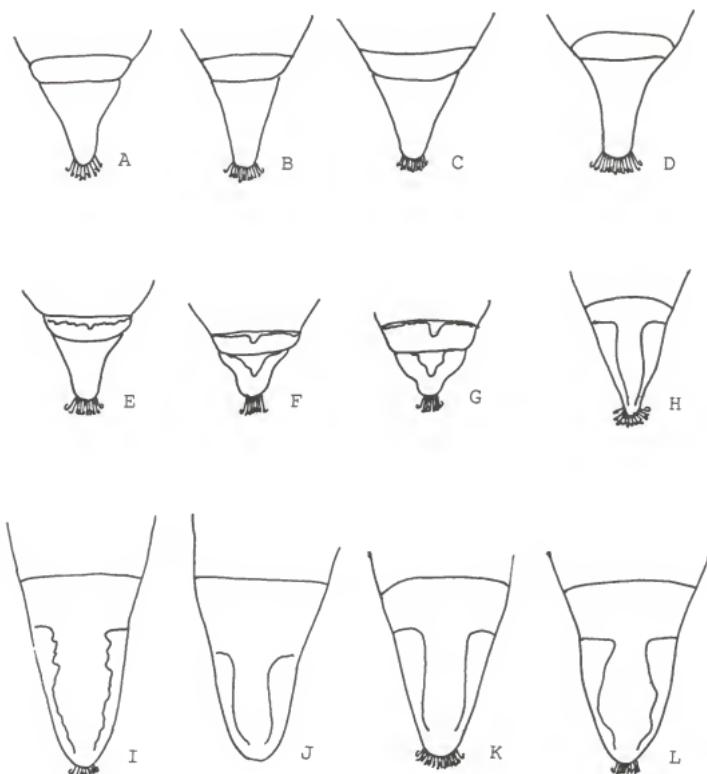


Figure 117. Dorsal view of the cremaster of *Pyrgus communis* (A), *P. oileus* (B), *Helioptetes ericetorum* (C), *H. lavianus* (D), *Celotes nessus* (E), *Pholisora catullus* (F), *P. alpheus* (G), *Synapte malitiosa* (H), *Nastra lherminier* (I), *N. julia* (J), *N. neamathla* (K), and *Cymaenes tripunctus* (L). All drawings are enlarged 12 times.

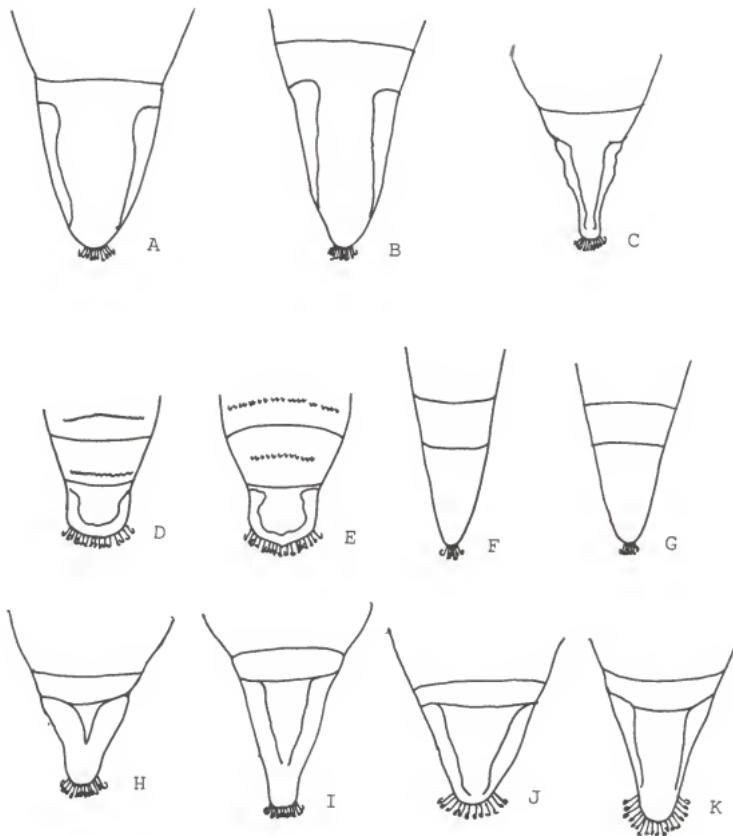


Figure 118. Dorsal view of the cremaster of *Lerema accius* (A), *L. liris* (B), *Perichares philetetes* (C), *Ancyloxypha numitor* (D), *A. arene* (E), *Copaeodes aurantiacus* (F), *C. minimus* (G), *Hylephila phyleus* (H), *Yvretta carus* (I), *Pseudocopaeodes eunus* (J), and *Hesperia uncas* (K). Drawings A-B and D-K are enlarged 12 times; C is enlarged 6 times.

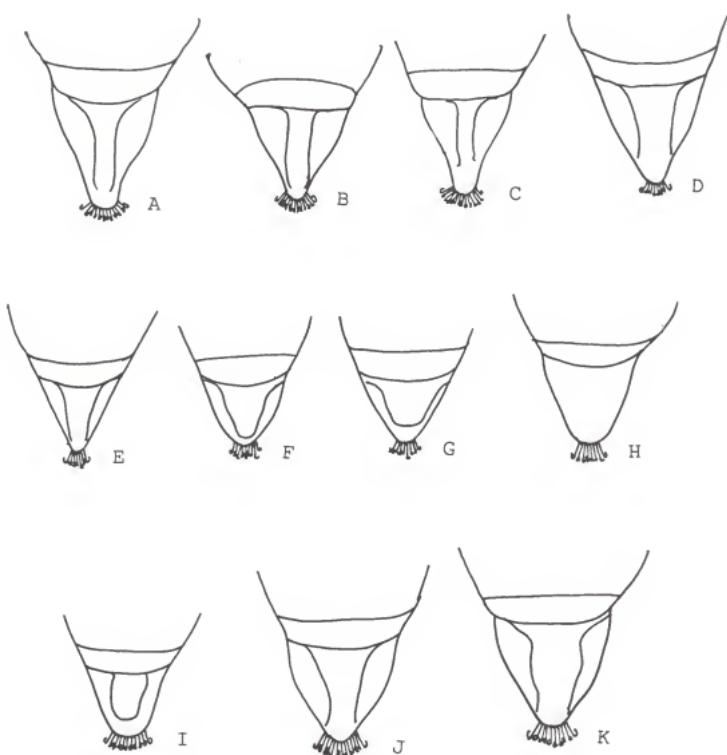


Figure 119. Dorsal view of the cremaster of *Hesperia comma* (A), *H. woodgatei* (B), *H. viridis* (C), *H. attalus* (D), *Polites coras* (E), *P. sabuleti* (F), *P. mardon* (G), *P. draco* (H), *P. baracoa* (I), *P. themistocles* (J), and *P. origenes* (K). All drawings are enlarged 12 times.

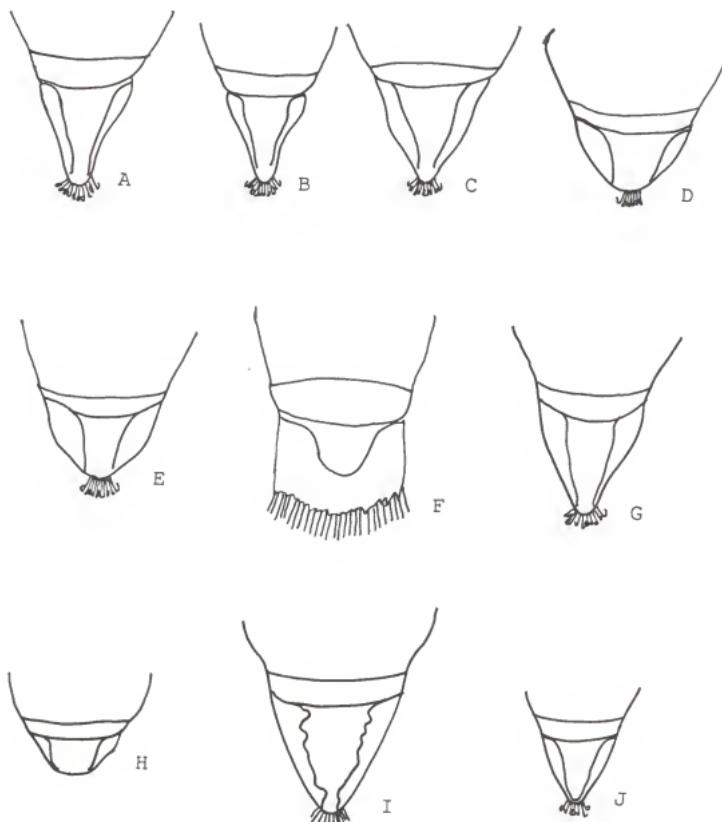


Figure 120. Dorsal view of the cremaster of *Polites mystic* (A), *P. sonora* (B), *P. vibex* (C), *Wallengrenia otho* (D), *W. egeremet* (E), *Pompeius verna* (F), *Atalopedes campestris* (G), *Atrytone arogos* (H), *A. delaware* (I), and *Problema byssus* (J). Drawings A-I are enlarged 12 times; J is enlarged 6 times.

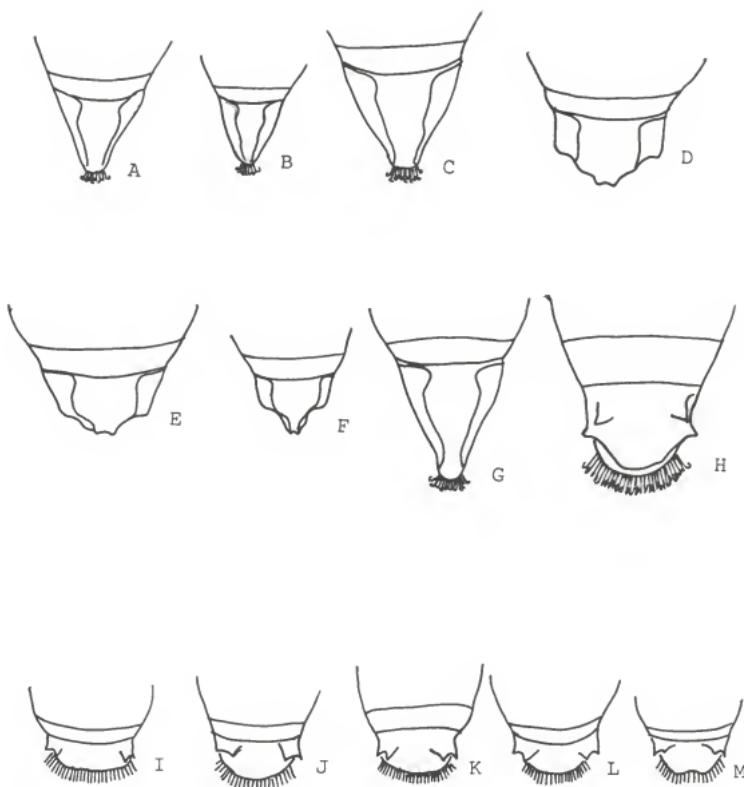


Figure 121. Dorsal view of the cremaster of *Ochlodessylvanoides* (A), *Poanes hobomok* (B), *P. taxiles* (C), *P. aaroni* (D), *P. yehl* (E), *P. viator* (F), *Paratrytone melane* (G), *Choranthus haitensis* (H), *Euphyes arpa* (I), *E. pilatka* (J), *E. alabamae* (K), *E. dukesi* (L), and *E. berryi* (M). Drawings A, C-E, G-H, and M are enlarged 12 times; B, F, and I-L are enlarged 6 times.

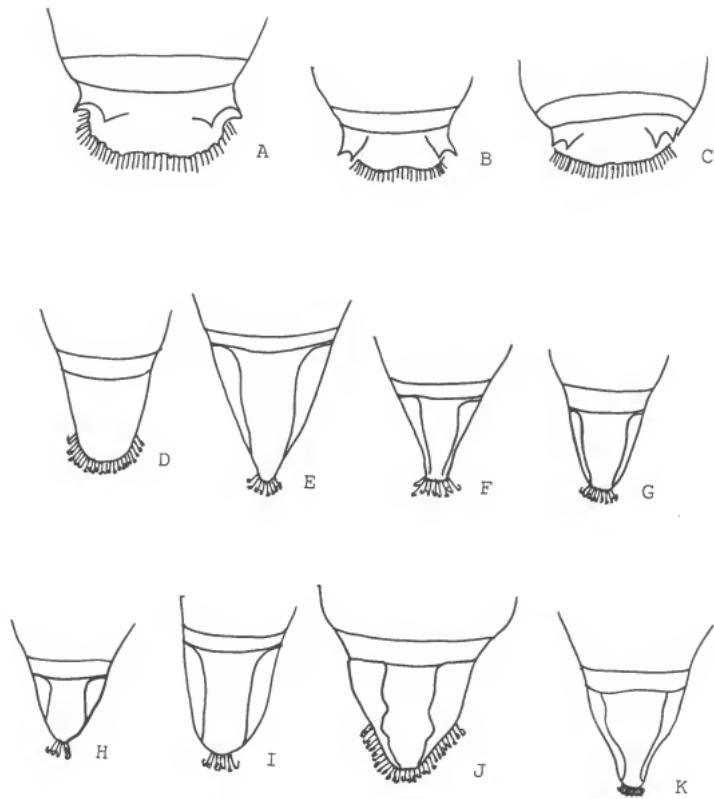


Figure 122. Dorsal view of the cremaster of *Euphyes macguirei* (A), *E. bimacula* (B), *E. ruricola* (C), *Asbolis capucinus* (D), *Atrytonopsis loammi* (E), *Amblyscirtes aesculapias* (F), *A. vialis* (G), *A. celia* (H), *Lerodea eufala* (I), *Oligoria maculata* (J), and *Calpodes ethlius* (K). Drawings A-C and E-J are enlarged 12 times; D and K are enlarged 6 times.

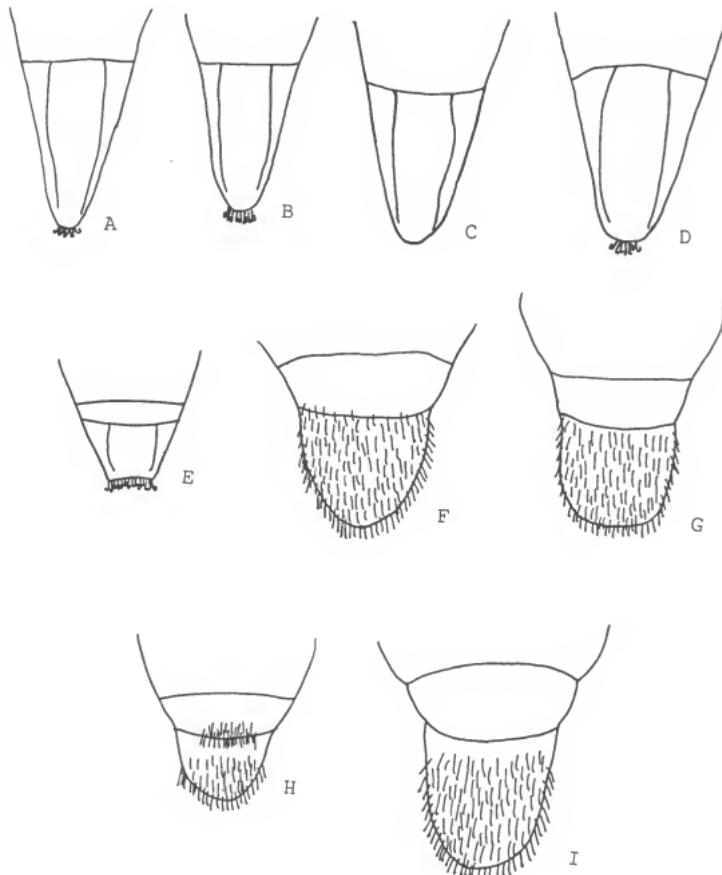


Figure 123. Dorsal view of the cremaster of *Panoquina panoquin* (A), *P. panoquinoides* (B), *P. ocola* (C), *P. sylvicola* (D), *Nyctelius nyctelius* (E), *Megathymus yuccae* (F), *M. coloradensis* (G), *M. cofaqui* (H), and *M. ursus* (I). Drawings A-E are enlarged 12 times; F-I are enlarged 6 times.

CHAPTER 6

TAXONOMIC KEYS TO THE IMMATURE STAGES

Preliminary Key to Eggs of U. S. Hesperiidae

(Subfamily and Genus)

- 1a. Egg diameter > 2mm *Megathyminae* (5)
- 1b. Egg diameter < 2mm (2)
- 2a. Egg with 30 to 50 vertical rows of short spines, on
Malvaceae *Celotes, Heliopetes, Systasea*
- 2b. Egg without rows of spines (3)
- 3a. Egg with 10 to 30 rows of vertical ribs, usually on
dicotyledonous plants *Pyrginae* (6)
- 3b. Egg with polygonal sculpturing or smooth, not ribbed .
..... (4)
- 4a. Egg on dicotyledonous plants (*Fabaceae*)
..... *Cogia* (*Pyrginae*)
- 4b. Egg on monocotyledonous plants
..... *Heteropterinae, Hesperiinae* (11)
- 5a. Egg green with red blotches or entirely red, on *Agave*
species *Agathymus*
- 5b. Egg brownish or white, on *Yucca* species *Megathymus*
- 6a. Egg red *Phocides*
- 6b. Not as above (7)

7a. Egg yellow or orange *Achlyodes, Autochton, Chioides, Gesta, Erynnis, Timochares, Urbanus, Zestusa*

7b. Not as above (8)

8a. Egg green *Cabares, Epargyreus, Erynnis, Polygonus, Pyrgus, Thorybes, Urbanus*

8b. Not as above (9)

9a. Egg white
.... *Achalarus, Ephyriades, Pholisora, Pyrgus, Thorybes*

9b. Not as above (10)

10a. Egg gray *Typhedanus*

10b. Egg brown *Pholisora, Staphylus*

11a. Egg green, yellow, or white with a red ring
Amblyscirtes, Ancyloxypha, Atrytone, Choranthus, Euphyes

11b. Egg lacking a red ring (12)

12a. Egg pink *Polites*

12b. Not as above (13)

13a. Egg pale green or whitish
Amblyscirtes, Atalopedes, Carterocephalus, Copaeodes, Cymaenes, Hesperia, Hylephila, Lerema, Lerodea, Nastra, Nyctelius, Oarisma, Ochlodes, Panoquina, Paratrytone, Perichares, Poanes, Polites, Pompeius, Problema, Pseudocopaeodes, Thymelicus, Wallengrenia

13b. Not as above (14)

14a. Egg gray *Calpodes*

14b. Egg brown *Atrytonopsis, Oligoria*

Preliminary Key to Last Instar Larvae of U. S. Hesperiidae
(Subfamily and Genus)

- 1a. Lenticles and usually an anal comb and a ventral prothoracic gland present; larva living in a leaf shelter or boring in AgavaceaeHesperiidae (2)
- 1b. Not as aboveother Lepidoptera
- 2a. More than 3 supraspiracular lenticles present on each side of abdominal segment 4; anal comb weakly developed or absent; larva boring in stems, roots, or leaves of AgavaceaeMegathyminae (5)
- 2b. Fewer than 3 supraspiracular lenticles present on each side of abdominal segment 4; anal comb well developed; larva usually living in a leaf shelter(3)
- 3a. Mandibles of pyrgine type; proleg lenticles one or two; bright yellow or red pigments present; larva usually feeding on dicotyledonous plants(4)
- 3b. Mandibles of hesperiine type; three or more proleg lenticles present; bright yellow or red pigments absent; larva feeding on monocotyledonous plants
.....Heteropterinae, Hesperiinae (35)
- 4a. Head with low vertical ridges; setae > 5mm long; ground color dull red with transverse yellow stripes; on *Quercus* speciesPyrrhopyginae (*Pyrrhopyge araxes*)
- 4b. Head lacking ridges; setae < 1mm long; ground color green, yellowish, or occasionally redPyrginae (6)

5a. Crochets arranged in transverse bands; thoracic segments enlarged; boring in *Yucca* species ..*Megathymus*

5b. Crochets arranged in a circle; abdominal segments 3-5 largest; boring into *Agave* species*Agathymus*

6a. Prothoracic legs brown, dark brown, or black(7)

6b. Prothoracic legs pale, red, or lightly sclerotized (tan)(14)

7a. Head with yellow, orange, or reddish eye patches ... (8)

7b. Head without colorful eye patches absent.....(10)

8a. Body setae with expanded tips, on *Combretaceae*

.....*Polythrix*

8b. Body setae simple, on *Fabaceae*(9)

9a. Head reddish brown with large yellow eye patches, body with a broad, yellow lateral stripe*Autochton*

9b. Head brown, lower face blackish, with orange or reddish eye patches, lacking a broad, yellow lateral stripe ...

.....*Urbanus*

10a. Setae on head feathery or branching, on *Malvaceae*

.....*Helioptetes, Pyrgus*

10b. Setae on head simple(11)

11a. Head light brown with 6 black spots on face, on *Fabaceae*

.....*Gesta*

11b. Head black(12)

12a. Crochets of each proleg of uniform size (irregularly triordinal), on *Fabaceae**Urbanus*

12b. Posterior crochets of each proleg much larger than anterior crochets (irregularly triordinal)(13)

13a. Prothoracic shield tan dorsally, brown laterally, on Lamiaceae and VerbenaceaeCabares

13b. Prothoracic shield darkly sclerotized, on Fabaceae*Achalarus, Thorybes*

14a. Prothoracic shield distinctly present, tan, brown, or black in color(15)

14b. Prothoracic shield absent or indistinct(23)

15a. Setae on head feathery or branching(16)

15b. Setae on head simple(18)

16a. Head with yellow or orange eye patches present, on Fabaceae*Typhedanus*

16b. Head uniformly dark, without pale eye patches, on Amaranthaceae and Chenopodiaceae(17)

17a. Prothoracic shield darkly sclerotized*Pholisora*

17b. Prothoracic shield lightly sclerotized (tan) or indistinct*Staphylus*

18a. Head uniformly black, without eye patches, on Convolvulaceae*Nisoniades*

18b. Head not black, colorful yellow or orange eye patches usually present(19)

19a. Body white, on Myrtaceae or Rhizophoraceae*Phocides*

19b. Body green or red with fine or broad yellow stripes(20)

20a. Head uniformly brown or reddish brown (except for eye patches) (21)

20b. Head brown with black patterns (22)

21a. Body with patches of black microspines and numerous narrow, pale yellow transverse stripes per segment, on Fabaceae *Epargyreus*

21b. Body lacking patches of black microspines, yellow stripes longitudinal or body red with 1 transverse yellow stripe per segment, usually on Fabaceae, occasionally on Aquifoliaceae, Asteraceae, Rhamnaceae, Trigoniaceae, or Verbenaceae *Astraptes*

22a. Head with two black eye spots on lower face, on Fabaceae *Chioides*

22b. Head without black eyespots, lower part of face black, on Fabaceae *Codatractus*

23a. Crochets arranged in a mesal penellipse (24)

23b. Crochets arranged in a complete or nearly complete circle (29)

24a. Head color light brown or with a contrasting pattern (25)

24b. Head uniformly dark brown or black (27)

25a. Crochets uniordinal, on Malvaceae *Systacea*

25b. Crochets multiordinal (26)

26a. Head setae branching, small yellow eye patches usually present, on Fabaceae *Cogia*

26b. Head setae simple, eye patches absent, on Malpighiaceae
..... *Timochares*

27a. Larva on Malvaceae *Celotes*

27b. Larva on Chenopodiaceae (28)

28a. Larva on *Chenopodium* species *Staphylus*

28b. Larva on *Atriplex* species *Pholisora*

29a. Head pale with 2 black eye spots on upper face, on
Fabaceae (30)

29b. Head brown or dark brown, without black eyespots ..(31)

30a. Head with a yellow and black lateral stripe ..*Polythrix*

30b. Head with a black lateral stripe *Polygonus*

31a. Upper most eye (stemma 1) at least twice as large as
the other eyes, usually on Rutaceae *Achlyodes*

31b. Eyes subequal in size (32)

32a. Head uniformly dark brown or black, without eye
patches, on Malvaceae *Carrhenes*

32b. Head brown or light brown, usually with orange spots or
eye patches (33)

33a. Body setae > 0.4mm in length, on Malvaceae ..
..... *Xenophanes*

33b. Body setae < 0.2mm in length, not on Malvaceae(34)

34a. Larva on Malpighiaceae *Ephyriades*

34b. Larva usually on Fabaceae or Fagaceae (sometimes on
Betulaceae, Rhamnaceae, or Salicaceae) *Erynnis*

35a. Prothoracic legs dark brown or black (36)

35b. Prothoracic legs pale, concolorous with body or lightly sclerotized (tan) (49)

36a. Head pale with or without dark stripes (37)

36b. Head black with or without pale stripes or spots .. (39)

37a. Body setae > 0.5mm long, head pale *Perichares*

37b. Body setae < 0.5mm long, head with dark stripes ... (38)

38a. Suranal plate with a black crescent *Atrytone*

38b. Suranal plate without dark markings *Nyctelius*

39a. Head black, unmarked (40)

39b. Head black with pale stripes or spots (42)

40a. Crochets arranged in a mesal penellipse, meso- and metathoracic legs pale *Pompeius*

40b. Crochets arranged in a circle or near circle, all thoracic legs dark (41)

41a. Thorax with a pale (yellowish or reddish in life) lateral stripe, larva living in a leaf case clipped from the host *Wallengrenia*

41b. Thorax lacking a pale lateral stripe, larva living in shelters of folded or tied leaves *Polites*

42a. Frons bearing 2 pale spots (43)

42b. Frons without pale spots (47)

43a. Pale eye patch with a central black spot *Hylephila*

43b. Eye patch absent or lacking a black spot (44)

44a. Suranal plate without black markings (45)

44b. Suranal plate with black markings (46)

45a. Body setae simple *Polites*

45b. Body setae with expanded tips *Hesperia*

46a. Suranal plate with 3 sharply delineated black lines ...
..... *Yvretta*

46b. Suranal plate markings irregular or diffuse *Polites*

47a. Body setae with expanded tips *Atalopedes*

47b. Body setae simple (48)

48a. Suranal plate with dark markings *Polites*

48b. Suranal plate without dark markings *Pseudocopaeodes*

49a. Prothoracic shield pale, indistinct (50)

49b. Prothoracic shield brown or black (at least the groove
between the major annuli dark) (55)

50a. Head pale, unmarked (occasionally faint stripes) ..(51)

50b. Head pale with bold reddish, brown, or black markings
..... (53)

51a. Crochets arranged in a mesal penellipse, suranal plate
pointed, body length < 20mm *Copaeodes*

51b. Crochets arranged in a circle or near circle, suranal
plate rounded, body length usually > 20mm.....(52)

52a. Body setae with blunt tips *Panoquina*

52b. Body setae simple *Thymelicus*

53a. Head brown with paler stripes, medial stripe dark brown
along the vertex *Lerodea*

53b. Head pale with dark stripes (54)

54a. Head with reddish stripes, the epicranial stripe
separate from the medial stripe *Nastra*

54b. Head with dark brown or black stripes, epicranial stripe broadly convergent with the medial stripe along the adfrontal sclerite *Cymaenes*

55a. Paraclypeal hooks present
.... *Amblyscirtes* (Hesperiinae), *Piruna* (Heteropterinae)

55b. Paraclypeal hooks absent (56)

56a. Head color uniform brown or pale orange (57)

56b. Head with dark stripes (60)

57a. Body setae > 1mm long *Atrytonopsis*

57b. Body setae < 1mm long (58)

58a. Head light orange, suranal plate broadly rounded and edged with black, on Arecaceae *Asbolis*

58b. Head brown, suranal plate not edged with black, on Poaceae (59)

59a. Posterior half of prothoracic dorsum dark, on Poaceae
..... *Oligoria*

59b. Only the groove between the major annuli of the dorsal prothorax dark, on Poaceae and Cyperaceae
..... *Poanes*, *Paratrytone*

60a. Head light brown with a central black spot on face and on area around the eyes, cuticle transparent in life, usually on Cannaceae and Marantaceae *Calpodes*

60b. Head with dark stripes, cuticle opaque (61)

61a. Only the groove between the major annuli of dorsal prothorax dark (62)

61b. Posterior half of prothoracic dorsum dark (65)

62a. Epicranial stripe present on face(63)
62b. Epicranial stripe absent(64)
63a. Epicranial stripe convergent with the medial stripe
 along the adfrontal sclerite*Lerema, Vidius*
63b. Epicranial stripe separate from the medial stripe
 *Atrytone*
64a. Frontal sclerite with dark stripes*Synapte*
64b. Frontal sclerite pale, without dark stripes ...*Ochlodes*
65a. Epicranial stripe broadly convergent with the medial
 stripe along the adfrontal sclerite(66)
65b. Epicranial stripe separate from the medial stripe or
 with narrow lateral connections (not broadly joined)
 (67)
66a. Medial stripe with a black elongate spot along the
 vertex (larva with a cyclopic appearance), body length
 usually > 25mm, on Arecaceae and Cyperaceae*Euphyes*
66b. Medial stripe not formed into an elongate spot, body
 length < 25mm, on Poaceae*Ancyloxypha*
67a. Frontal sclerite with dark stripes*Problema*
67b. Frontal sclerite pale, without dark stripes
 *Choranthus*

Preliminary Key to Pupae of U. S. Hesperiidae

(Subfamily and Genus)

1a. Lenticles present on prothorax and/or abdomen,
 proboscis extending beyond the wing tips, pilifers
 usually touching*Hesperiinae* (11)

- 1b. Lenticles absent, proboscis extending to the wing tips or shorter, pilifers separated by the labial sclerite (2)
- 2a. Setae > 2mm in length
 - *Pyrrhopyginae (Pyrrhopyge araxes)*
- 2b. Setae < 2mm in length (3)
- 3a. Proboscis extending to the wing tips *Pyrginae* (5)
- 3b. Proboscis much shorter than the wing tips, only reaching about to the tip of the middle legs
 - *Megathyminae* (4)
- 4a. Cremaster broadly rounded with abundant stiff setae ...
 - *Megathymus*
- 4b. Cremaster pointed, setae absent *Agathymus*
- 5a. Posterior margin of the prothorax crenulated, irregular (6)
- 5b. Posterior margin of the prothorax straight (7)
- 6a. Pupal cap with a short pointed process *Polythrix*
- 6b. Pupal cap rounded *Achalarus, Astraptes, Autochton, Cabares, Chioides, Codatractus, Thorybes, Urbanus*
- 7a. Thoracic spiracle guard absent or indistinct (8)
- 7b. Thoracic spiracle guard well developed (9)
- 8a. Pupal cap and anterior margin of eyes each with a short, pointed process *Polygonus*
- 8b. Pupal cap with a mesal bulge bearing a shallow indentation *Phocides*

9a. Longest setae > 0.5mm *Carrhenes, Celotes,*
Helioptetes, Pholisora, Pyrgus, Staphylus, Systasea

9b. Longest setae < 0.5mm (10)

10a. Pupal cap with a short pointed process *Achlyodes*

10b. Pupal cap rounded
..... *Cogia, Chiomara, Ephyriades, Erynnis, Gesta*

11a. Pupal cap with a pointed process (12)

11b. Pupal cap rounded (17)

12a. Antennal tip extending to near tip of middle leg .. (13)

12b. Antennal tip far cephalad of tip of middle leg (14)

13a. Body length < 25mm, process on pupal cap short
..... *Synapte*

13b. Body length > 25mm, process on cap relatively long
..... *Perichares*

14a. Proboscis extending beyond abdominal segment 7 (15)

14b. Proboscis not extending beyond A 7 (16)

15a. Proboscis extending well beyond the tip of the
cremaster, body length > 40mm *Calpodes*

15b. Proboscis not extending beyond the tip of the
cremaster, body length < 40mm
..... *Cymaenes, Lerema, Lerodea, Nastra*

16a. Body length < 25mm *Copaeodes*

16b. Body length > 25mm *Panoquina*

17a. Cremaster with a short, medial, ventral spine (18)

17b. Cremaster without a medial spine (19)

18a. Proboscis extending beyond the cremaster *Atrytone*

18b. Proboscis not extending beyond abdominal segment 6
..... *Ancyloxypha*

19a. Cremaster tapering to a blunt point(27)

19b. Cremaster broadly rounded or squarish, not tapering to
a point(20)

20a. Cremaster with hooked setae(21)

20b. Cremaster without hooked setae(25)

21a. Proboscis extending into abdominal segment 7(22)

21b. Proboscis extending only into A 6*Pompeius*

22a. Cremaster rounded(23)

22b. Cremaster squarish*Nyctelius*

23a. Cremaster with a few short dorsolateral spines
..... *Choranthus*

23b. Cremaster without spines(24)

24a. Cremaster with hooked setae in a medial tuft
..... *Wallengrenia*

24b. Cremaster with hooked setae in a row along the distal
margin*Asbolis*

25a. Cremaster with a few short dorsolateral spines
..... *Euphyes*

25b. Cremaster without spines(26)

26a. Distal tip of cremaster with a mesal indentation
..... *Poanes*

26b. Distal tip of cremaster rounded, not indented
..... *Atrytone*

26a. Distal tip of cremaster bearing a tuft of hooked setae
..... *Amblyscirtes, Atalopedes, Atrytonopsis,*
Hesperia, Hylephila, Ochlodes, Paratrytone, Poanes,
Polites, Problema, Pseudocopaeodes, Yvretta

27b. Cremaster with hooked setae in a row along the distal
margin *Oligoria*

CHAPTER 7

SUMMARY AND CONCLUSIONS

Although a large literature exists on the immature stages of U. S. skippers, previous authors have largely described superficial characters, without reference to other species. This project furthers our understanding of the biology and morphology of immature stages of U. S. hesperiids by determining the extent of their biological and morphological variation, comparing their biology and morphology in a standardized way, and providing keys for their identification.

Biology

Most hesperiids are leaf feeders that hide in shelters of folded or tied leaves. The Megathyminae have diverged greatly from other skipper groups in that these larvae are borers in the leaves, stems, and roots of plants in the Agavaceae. The genus *Agathymus* (Megathyminae) is unique in largely feeding on the host's sap during the later instars.

Skipper butterflies tend to be specialized in their choice of host plants. Some 92% of the U. S. hesperiids feed on only one family of plants. At the other extreme, one species, *Astraptes fulgerator* (Pyrginae), has been recorded from plants of six different families. Species

having relatively broad host ranges, but mostly within one plant family, include *Lerema accius* (48 hosts), *Urbanus proteus* (38 host spp.), *Pyrgus communis* (35 spp.), *Epargyreus clarus* (31 spp.), *Thorybes pylades* (27 spp.), and *Megathymus yuccae* (27 spp.).

Overall, 31 families of plants are eaten by hesperiids recorded from the U. S., including 8 families of monocots and 23 families of dicots. Hesperiinae, Heteropterinae, and rarely Pyrginae feed on monocots, whereas Pyrrhopyginae and most Pyrginae eat dicots. At least 138 new host records are reported for 55 species of U. S. Hesperiidae. Host plants remain to be discovered for 22% of the 290 skipper butterflies recorded from the U. S.

The eggs of skippers may be brownish, pinkish, white, yellow, green, or red. Adult females usually deposit the eggs singly on the host leaves, but some species oviposit on other substrates. A few pyrgines such as *Autochton cellus* and *Urbanus proteus* lay short strings of eggs. The head of the first instar larva is usually black. Later instars may develop stripes, spots, or colorful eye patches on the head. Frass is usually propelled away from the larva by the anal comb. Megathymines, however, have degenerate anal combs and simply drop the frass pellet from the anus.

Hesperiid larvae are attacked by parasitic wasps, such as braconids, ichneumonids, and eulophids, as well as tachinid flies. Secretions from the ventral prothoracic

gland may deter invertebrate predators. Defenses used to protect against vertebrate predation include dropping to the ground and remaining motionless, cryptic as well as aposematic coloration, aggressive displays, regurgitation of fluids from the mouth, and defecation.

Skipper larvae usually have five larval instars, and occasionally more. Most U. S. species overwinter as partly or fully grown larvae and sometimes as fully formed larvae within eggs, first instars, or pupae. The last instar of hesperiines and megathymines may produce particles of white wax from specialized glands on the ventral side of the abdomen. The wax is used by the larva to coat the inside of the cocoon or plug the pupal chamber. The pupa of most skipper butterflies is supported in the cocoon by a silk thread about the middle, and the cremaster is anchored by hooked setae to a small pad of silk. Megathyminae and some hesperiines do not have hooked setae on the cremaster and do not anchor the pupa to the cocoon. Megathyminae pupate within the larval burrows.

Future research on the biology of U. S. hesperiids should be directed towards investigating species whose life history is currently not known. In addition, errors in the use of particular plants by skipper larvae have been incorporated into the literature due to mistaken plant and butterfly identification, misinterpretation of old illustrations and common names, ovipositional mistakes or

deliberate oviposition on nonhosts, and laboratory rearings. Biologists should attempt to discover new host plant associations, as well as verify published records.

Morphology

The eggs of U. S. hesperiids range in height from 0.4 to 1.8mm and in diameter from 0.6 to 3mm. Megathyminae, Hesperiinae, and rarely Pyrginae have polygonal patterns of sculpturing on the eggs. Pyrgines usually have 10 to 50 vertical ribs or rows of short spines and vary from 0.5 to 1.3mm in height and 0.6 to 1.8mm in width. Similarly, hesperiine eggs range in height from 0.4 to 1.2mm and width of 0.6 to 1.6mm. In comparison, megathymines have very large eggs (height = 1.3-1.8mm, width 2.5-3mm). No specimens of Pyrrhopyginae or Heteropterinae eggs were located for study. Those of the Heteropterinae have been described as having vertical grooves.

Last instar larvae of U. S. hesperiids vary in length from 8 to 86mm. The width at A4 ranges from 1.6 to 11.7mm and the transverse width of the head may be 1.5 to 7.2mm. Pyrgines tend to be somewhat shorter and thicker bodied than hesperiines. Pyrgine lengths range from 8 to 49mm, while hesperiines may be 9.8 to 63mm long. Body widths vary 1.8 to 9.8 for pyrgines and 1.6 to 9.5mm for hesperiines. Pyrgines also have wider heads than hesperiines, 2 to 6.4mm and 1.5 to 4.4mm respectively. Megathymines are usually much larger and thicker than other skippers. Body lengths

of megathymines range from 19 to 86mm. Body width varies from 5.8 to 11.7mm, and head width may be 3.3 to 5.8mm.

Interesting morphological characteristics of hesperiid larvae that may be useful in phylogenetic analyses include the type of mandible articulation, setal types, sculpturing of the head, lenticle distribution, wax gland patterns, and presence of red or yellow pigments.

Pyrrhopygines, pyrgines, and megathymines have mandibles typical of higher lepidopterans. Heteropterines and hesperiines have a modified type of articulation.

Pyrgines frequently have modified setae with expanded tips on the body or branching setae on the head. Some hesperiines also have setae with expanded tips.

Pyrrhopygines have ridges on the head, a sculpturing pattern not found in other groups. Lenticle patterns also vary between subfamilies. Pyrgines sometimes have numerous lenticles on the ventral side of the prothorax, a feature shared by some Old World coeliadines. Only one or two lenticles on the prolegs are characteristic of pyrrhopygines and pyrgines. Hesperiinae have 4 to 15 lenticles at this position. Subdorsal lenticles are not usually present in pyrrhopygines or pyrgines, but frequently occur on hesperiines. Megathymines also have lenticles, but differ from other subfamilies in their distribution. In megathymines, the lenticles on the abdomen are often in a supraspiracular cluster, ranging from 3 to 15 per side of

segment. Wax glands occur only in the Megathyminae, Hesperiinae, and probably Heteropterinae. Patches of wax glands may occur on the ventral side of abdominal segments one, three to six, or seven and eight. Bright red, orange and yellow pigments frequently occur in Pyrginae and Pyrrhopyginae larvae.

Hesperiid pupae range in length from 10.5 to 52mm and in width from 2.1 to 10.3mm. Megathymines have the largest pupae (length = 34-52mm, width = 8-10.2mm). Pyrgines tend to be shorter and wider than hesperiines. Lengths range from 10.5 to 32mm for pyrgines and 12.5 to 43.5mm for hesperiines. Widths vary from 3.2 to 10.3mm for pyrgines and 2.1 to 8.5mm for hesperiines.

Promising comparative characteristics of hesperiid pupae include the shape of the pupal cap (usually rounded, sometimes pointed), the length of the antennae and proboscis, cremaster shape, type of thoracic spiracle guard, and presence of crenulations on the posterior margin of the prothorax. Hesperiines and some pyrgines have pointed processes on the head of the pupa. Pyrrhopygines, many pyrgines, megathymines, and rarely hesperiines have antennae that extend to the tip of the middle leg. In some pyrgines and most hesperiines, the distal tip of the antenna lies far cephalad of the distal tip of the middle leg. The proboscis of megathymines is greatly reduced (much shorter than the wing tips), whereas most hesperiines have long or very long

probosci (extending beyond the wing tips or sometimes the beyond the cremaster). In pyrrhopygines and pyrgines, the proboscis is subequal to the wing tips. The cremaster of hesperiids usually tapers to a blunt point with a cluster of hooked setae at the tip, but hesperiines display several other variations. The cremaster of *Megathymus* species is broadly rounded and has many stiff, unhooked setae.

Agathymus species usually have a pointed cremaster that lacks setae. The spiracle guard of pyrgines is often greatly enlarged and positioned on a small cuticular rise. Hesperiines simply have a small mound of microspines protecting the spiracle. A few species lack the spiracle guard. Lastly, many pyrgines have small crenulations on the posterior margin of the prothorax. No other subfamilies have this character.

Descriptions are presented for the first time for the eggs of 16 species, the larvae of 41 species, and the pupae of 35 species of Hesperiidae found in the U. S. Overall, diagnoses are given for the eggs of 49 species, larvae of 156 species, and pupae of 120 species. Immature stages of 26% of the 290 U. S. species remain to be described. About half of the undescribed species are true residents that maintain breeding populations. The other half are tropical species that rarely enter the U. S. and do not reproduce within its limits. Very little is known of the immature stages of the diverse neotropical fauna. Moss's (1949)

brief descriptions, drawings, and biological notes remain the most comprehensive treatment. Preliminary taxonomic keys are provided for the known eggs, larvae, and pupae of the Hesperiidae of the U. S.

Taxonomic Insights and Problems

The immature stages of butterflies are rarely considered in classification, but may provide an alternate set of data quite useful in determining phylogenetic relationships. Of the species described above, some clearly show close relationship, but may be widely separated in the Miller and Brown (1984) check list. Among other problems are species with very different immatures included presently within a single genus. The following observations are intended to point out hesperiid taxa in need of closer scrutiny, and perhaps, revisionary studies.

At the subfamily level, the immature stages of Pyrrhopyginae and Pyrginae are similar. Likewise, Hesperiinae and Megathyminae are related. The preceding subfamily diagnoses list shared derived characteristics of each of these groups.

Very few specimens of Heteropterinae were available for study. Published descriptions of *Carterocephalus palaemon* indicate a close affinity with Hesperiinae. The mature larvae of *Piruna pirus* (Heteropterinae) have paraclypeal hooks, a derived characteristic observed only in one other genus, *Amblyscirtes* (Hesperiinae). I can find no evidence

among the immature stages to support subfamily rank for *Heteropterinae*, based on the larva of this one species.

Some related genera within *Pyrginae* are *Epargyreus*, *Chioides*, *Codatractus*, *Urbanus*, *Astraptes*, *Autochton*, *Achalarus*, *Thorybes*, and *Cabares*. The pupae of these genera have crenulations on the posterior margin of the prothorax. In addition, their larvae are often very colorful with large yellow or orange eye patches and usually feed on legumes. The larvae of *Phocides* and *Cogia* also have larvae with colorful eye patches, but their pupae lack the crenulations.

Staphylus, *Carrhenes*, *Xenophanes*, *Systasea*, *Pyrgus*, *Helioptetes*, *Celotes*, and *Pholisora* also appear to be related. The larvae of these genera usually have black or dark brown heads with branching setae, and feed on *Malvaceae*, *Chenopodiaceae*, or *Amaranthaceae*.

A third group of pyrgines includes *Timochares*, *Chiomara*, *Gesta*, *Ephyriades*, and *Erynnis*. The larvae of these genera have an indistinct prothoracic shield, short setae, and feed on a variety of plants, particularly *Malpighiaceae*, *Fabaceae*, and *Fagaceae*.

Urbanus, *Astraptes*, and *Polythrix* are polyphyletic taxa. *Urbanus* species with iridescent blue adults have colorful larvae. Species with brown adults have brown larvae that are similar to *Achalarus* and *Thorybes*. The larvae of some *Astraptes* species resemble *Epargyreus*, while others have a *Pyrrhopyge*-like appearance. The larvae of

Polythrix mexicanus and *Polythrix procera* are so wildly different, that they must represent different genera. It is interesting that the larvae of *Polygonus leo* and *Polythrix mexicanus* are similar, but their pupae are not. The remaining genera, *Nisoniades* and *Achlyodes*, do not seem to have any close relatives in the U. S. fauna, but *Nisoniades* probably belongs more with *Timochares-Erynnis* rather than *Staphylus-Pholisora*.

Within the hesperiines, *Synapte*, *Vidius*, *Lerema*, *Nastra*, *Cymaenes*, *Copaeodes*, *Thymelicus*, *Lerodea*, *Calpodes*, and *Panoquina* seem to be related. These larvae are green or whitish and usually have striped heads. Some develop longitudinal wax glands on the ventral side of A7-8. The pupae all have a pointed process on the cap. *Vidius* and *Lerema* are very similar.

The larvae of *Ancyloxypha*, *Atrytone*, *Problema*, *Ochlodes*, *Euphyes*, and *Nyctelius* are greenish with striped heads and live on the leaves of grasses. *Hylephila*, *Yvretta*, *Pseudocopaeodes*, *Hesperia*, *Atalopedes*, and *Polites* have brownish larvae with dark heads and live at the base of the host plant. *Wallengrenia* and *Pompeius* are closest to this group of hesperiines, but have a number of differences. All of these skippers have pupae with rounded heads.

Other associations include *Atrytonopsis* and *Oligoria* whose larvae are similar in general appearance, and feed on *Andropogon* species. *Asbolis* and *Choranthus* have similar wax

glands in the form of small spots posterior of the proleg on A3-6. Some *Choranthus* species feed on palms as does *Asbolis capucinus*. The immatures of *Poanes* and *Paratrytone* are very similar in general appearance. *Perichares philetis* is curious in having the antennae extending to the tip of the middle leg of the pupa (a pyrgine characteristic) and transverse wax glands on the ventral side of A1. The pupa of *P. philetis* has a long pointed process.

Much remains to be discovered about the biology and immature stages of the Hesperiidae of the U. S. There is also much potential for using characteristics of the immature stages to develop hypotheses on the evolution of this family.

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BIOGRAPHICAL SKETCH

Marc Claude Minno was born 2 March 1956 in Johnstown, Pennsylvania. While a young boy, many summer days were spent searching the fields and forests about his home in western Pennsylvania for wood nymphs, swallowtails, fritillaries, question marks, and other species. The metamorphosis of monarchs, swallowtails, and checkerspots held great interest and wonderment. Marc attended Vinco Elementary School grades 1-8. In 1974 he graduated from Central Cambria High School and went on to study entomology at Purdue University. While attaining his bachelor's degree from Purdue, Marc worked as a technician in the university entomological collection. Much time was devoted to collecting, preparing, and identifying aquatic insects, especially mayflies. It was also during this period that Marc was able to curate a large collection of Lepidoptera, renewing his interest in butterflies. After graduating from Purdue in May 1978, Marc entered the University of California at Davis. Working with Dr. Arthur M. Shapiro, he studied skippers in the Cauca Valley, Colombia, as well as in California. After graduating with a Master of Science degree in entomology in May 1981, Marc was employed briefly as a biologist for the California Department of Fish and

Game. In March 1982, he began working for the University of Florida at the Institute of Food and Agricultural Sciences in Fort Lauderdale on the biological control of hydrilla. Marc married Maria Frances Rosiello Lain on 10 October 1982. Angela Katharine Minno was born on 25 April 1984. During the fall of 1984, Marc entered the University of Florida and with Dr. Thomas C. Emmel, continued to study butterflies in Florida, Colorado, and Hispaniola. Marc and Maria's second child, Ivan Alain Minno, was born on 17 September 1990. Marc hopes to continue his interest in the early stages and natural history of butterflies and moths.

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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This dissertation was submitted to the Graduate Faculty of the Department of Zoology in the College of Liberal Arts and Sciences and to the Graduate School and was accepted as partial fulfillment of the requirements for the degree of Doctor of Philosophy.

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